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With the kind regards of the Author.

LECTURES

ON

MASSAGE & ELECTRICITY

IN THE

TREATMENT OF DISEASE.

(MASSO-ELECTROTHERAPEUTICS.)

BY

THOMAS STRETCH DOWSE, M.D.,

FELLOW OF THE COLLEGE OF PHYSICIANS OF EDINBURGH;
FORMERLY PHYSICIAN SUPERINTENDENT OF THE CENTRAL LONDON SICK ASYLUM;
ASSOCIATE MEMBER OF THE NEUROLOGICAL SOCIETY OF NEW YORK, ETC.

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THESE LECTURES ARE DEDICATED TO

DR. WEIR MITCHELL,

PROFESSOR OF DISEASES OF THE MIND AND NERVOUS SYSTEM

AT THE

PHILADELPHIA POLYCLINIC AND COLLEGE

FOR GRADUATES IN MEDICINE.

WITH EVERY FEELING OF ESTEEM AND REGARD,

BY THE AUTHOR.

PREFACE.

The following Lectures on *Massage and Electricity* may be found of some interest to those who are desirous of becoming acquainted with these subjects.

The Author hopes that in their publication his worst enemies will see no reason to insinuate that they have been produced from any other than purely professional motives. He has no connection with advertising Schools of Massage, Institutes of Massage, Agencies for Massage, or Homes for Massage. He has endeavoured to deal with the problems involved in a spirit of scientific inquiry and research; and he lays no claim to any special merit or originality, neither has he brought forward any *wonderful* cases that he has cured. He believes and he hopes that the most impartial reader will see that his chief aim has been, after considerable practice, to set forth the results of his experience and labours in a plain, simple, and ungarnished statement of facts.

Massage and Electricity are very useful agents in the curative treatment of certain forms of disease, and it is unfortunate for their advancement as therapeutic agents when they are used in an indiscriminate and casual manner.

He is indebted to Mr. SCHALL, Electrician, of Wigmore Street, Cavendish Square, London, W., for numerous woodcuts illustrating the Lectures on Electricity.

THE AUTHOR

14, WELBECK STREET,
CAVENDISH SQUARE, LONDON, W.

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INTRODUCTION.

It is extremely interesting, but in no way astonishing, that the treatment of certain conditions of disease by massage should have become so popular within so short a period. Our continental friends are to be credited with having first made the attempt to systematize "Movement Cures," but it cannot be said at the present time that their knowledge in reference to this subject is in any way superior to our own.

In Germany the treatment of chronic disease by massage is extremely valued amongst both physicians and surgeons of known eminence, and with the people it is exceedingly popular. In our own country it is gradually and surely making way, and in due course there can be no doubt that it will create and maintain a position as a curative agent of the very highest value.

When people say that massage is as old, if not older, than any other form of treatment, they are wrong. Medical rubbing and anointing with unguents, and slapping and thumping the body, were (if we read the history of medicine) common modes of treatment; but we claim something more for massage than this: we say that massage consists of a series of movements classified and arranged in order to produce certain definite well-known physiological effects; and its combination with the induced electric current passed through the body of the masseur, adds greatly to its value.

I am sorry to say that facts are coming to my knowledge which are detrimental in the highest degree to the best interests of massage—I refer specially to the growing practice of masseusés operating upon male patients. This is very wrong in every way, and should be discountenanced in the most determined and positive manner by all members of the profession; it is immoral, disgusting, degrading, and utterly unjustifiable.

Dr. Graham in his very excellent work, "A practical treatise on Massage," devotes a considerable amount of space to the history of massage which is highly interesting—one might almost say classical, but I have no intention to give more than a few lines by way of introduction to this part of the subject. Hippocrates, 380 B.C., said: "The physician must be experienced in many things, but assuredly also in rubbing. For rubbing can bind a joint that is too loose, and loosen a joint that is too rigid. And again, rubbing can bind and loosen, can make flesh and cause parts to waste. Hard rubbing binds; soft rubbing loosens; much rubbing causes the parts to waste; moderate rubbing makes them grow." It is interesting to know that Hippocrates had some very accurate ideas relative to rubbing an extremity, although he could not have been aware of the circulation of blood. He says, "that rubbing upwards in the case of the limbs had a more favourable effect than rubbing downwards." The wise and able Emperor Hadrian, A.D. 76-138, who will be so well remembered as having built the wall from the Solway Frith to the Tyne, and whose reign was distinguished by peace and beneficent energy, one day seeing a veteran soldier rubbing himself against the marble at the public baths, asked him why he did so. The veteran answered, "I have no slave to rub me." Whereupon the Emperor gave him two slaves and sufficient to maintain them. Another day several old men rubbed themselves against the wall in the Emperor's presence, hoping for similar good fortune, when the shrewd Hadrian, perceiving their object, directed them to rub one another. Plutarch tells how Cæsar was cured of a general neuralgia by being manipulated daily by a slave.

In India, as in ancient Greece, it is common for the groom to rub his horse with his own naked hand, in consequence of which it is said the horses have a much finer coat than the English horses, which receive so much attention from the curry-comb and brush.

Ambroise Paré, A.D. 1517-1519, the most renowned surgeon of the sixteenth century, though not recognised by the faculty as he was only a barber surgeon, describes three kinds of friction: (gentle, medium, and vigorous;) and the effects of each. In dislocations he recommends that the joint should be moved about this way and that way, not violently, but in order to dissolve the effused fluids, and extend the fibres and the ligaments, so as to facilitate the reduction.

Hoffman, A.D. 1660-1742, says in his work "Medicina Rationalis Systematica," "The human body, like all other bodies in nature, possesses material forces, by means of which it effects its movements. All these forces may be reduced to mechanical and mathematical principles. An imponderable but material agent, æther, *the active moving force*, animates all tissues of the body, and presides over physical phenomena in every domain in creation." Æther is the fundamental cause of all vital motion. He further says, "Medicine will never progress until we closely examine the nature of this form of motion originating in the sentient soul; and until we apply to medicine the laws of mechanics and hydraulics." In his writings "Dissertationes Physico Medicæ," 1708, the sixth division of the first volume bears the superscription, "Motion the best means of cure for the body." And in the first chapter, "On the attainment of long life," he quotes the saying of Celsus, "The best of all medicines is none."

When we consider that Hoffman wrote his celebrated work at the beginning of the last century, we cannot sufficiently admire the illumined mind which shews itself throughout his writings.

The preface to the work cited might have been written by Skoda himself; and such clearness, moderation, and love of truth are displayed in it, that it merits a reproduction here. He says, "He who carefully observes and tests nature's art of healing, is forced to the conclusion that the basis of all health, life, and disease, is an exceedingly simple one, which never changes and is never confused. It is a matter of surprise, therefore, that physicians have invented so many means of cure to preserve health and to combat disease. Nature maintains life by simple processes. A few contrivances serve her for the preservation of health, nor are the causes of disease many. It is justifiable, therefore, to assume that the remedies to be used in restoring health should be neither complicated nor numerous. Indeed, we may not only assume, but I most positively affirm (and it may be put down to the misfortune or abuse of therapeutics), that the mass of medicaments and elixirs found in the works of both ancient and modern physicians, have had no other purpose than to impede the art of healing, and to make it uncertain and deceptive. Certainly the medicines by means of which the physician can support the efforts of nature, achieve success, cure the sick, and win honour for himself, are by no means numerous. There are many things which, though they appear to have little influence in the healing of disease, or the preservation of health, yet possess unthought-of power. Of this kind are those six matters called the natural, namely, air, food, motion and rest, sleeping and waking. The intelligent application of these may be of the greatest service in the art of healing without medicaments. We have an example of their power in the influence of movement and in the exercise of the limbs. The influence of exercise is so strong—if we can believe the testimony of the ancients and of our own experience—that where disease is to be prevented or cured, it is to be prized more than the most costly medicaments."

There are few physicians in this country at the present time who study the treatment of disease from the physical or the mechanical side to the extent that some would have them do. Dr. Stone elucidates this in his Harveian Oration, delivered at the Royal College of Physicians, October 18th, 1887, when speaking of the essentially physical and mechanical character of Harvey's great discovery of the circulation of the blood. His remarks are interesting and are as follows: "Now at the present time, investigation and research are abundantly carried on in the pathological, physiological, and therapeutical aspects of medicine, but the physical or mechanical side is somewhat neglected. For hundreds of ardent questioners of nature, who are labouring with the microscope, in the biological and the bacteriological laboratories, those who attack medicine from its physical side may be counted on the fingers of one hand. Nor indeed are the written treatises on this subject abundant, in this country at least. The "Animal Mechanics," of the Rev. Dr. Haughton, of Trinity College, Dublin, is an exceptional work of great value, which has hardly received the attention it deserves from the medical profession, but it stands almost alone as the representative of its class. On the continent, however, and in America the case is very different. The admirable "Medical Physics," of Professor Wundt, of Heidelberg, has been translated from the German into French, with valuable additions by Dr. Ferdinand Monayer, who regularly lectures on medical physics at the Lyons Faculty of Medicine, and affords a storehouse of information of the highest value to the medical practitioner.

Dr. John C. Draper, Professor of Chemistry and Physics in the Medical Department of the University of New York, has also made a valuable contribution to the literature of this subject in his "Text-book of Medical Physics," published the year before last. There is, indeed, a small but scanty manual by Dr. McGregor Robertson, the Muirhead Demonstrator of Physiology in the University of Glasgow, published in Cassell's Student's Series, but it is entirely unfit to compete with the two exhaustive treatises named before.

As with the bibliography, so with the teaching. With the exception of a course of lectures which the present speaker has delivered since 1871 in St. Thomas' Hospital, I am not aware of any systematic attempt in London to teach the medical student the vast mass of physical facts which underlie the daily practice of medicine. This college, however, forms an honourable exception, for it has on two occasions kindly given me the opportunity to bring before my brother physicians some few of what our Harvey terms "Nova vel Noviter inventa" —respecting the Physical Basis of Auscultation in the Croonian, and the Electrical Conditions of the Human Body in the Lumleian, lectures of a few years back.

It is true that the University of London, in its Preliminary Scientific Examination for the degree of Bachelor of Medicine, requires students to satisfy their examiners in physics by means of a written paper. But this paper is the same as that set to Bachelors of Science not medical. It is a terrible stumbling block to the rising medical generation; it bristles with what the late genial Professor De Morgan, himself a mathematician of the highest order, delighted to call mathematical conundrums; it is set by pure physicists, who know nothing, and probably care little, for the problems which interest us as medical men. It contributes a large percentage to the slaughter of innocent aspirants to the higher degrees in medicine, on which one of their most distinguished graduates, now Censor of this College, has feelingly and righteously commented. In the sixteen years during which I have carefully read the papers there set, I have never once seen a question directly or indirectly bearing on the physics of medicine.

The fact is that the large, difficult, and somewhat heterogeneous branch of knowledge connoted by the word physics is rapidly splitting into several independent portions. There are now distinctly molecular, mathematical, industrial, and physiological physics. It is the last of these with which we are concerned. The third or industrial branch has been enormously developed of late by the technical colleges at Bristol, Manchester, in the City guilds, at Kensington, and elsewhere. The mathematical branch is well cared for by the two old Universities of Oxford and Cambridge, but the physiological section has been hitherto hardly enough recognised by our teaching bodies. Surely an earnest student should be able somewhere to obtain information as to the natural laws on which the stethoscope, the microscope, the ophthalmoscope, and the sphygmograph are founded, without having to wade through interminable problems on the C. G. S. system of units, or vortex theories of matter, or—chimera of chimeras—the possibility and advantages of four-dimensional space.

In the year 1825 there lived at Oxford a surgeon, John Grosvenor, who wrote a book full of interest, entitled "An account of a system of Friction as adopted and pursued with the greatest success in cases of contracted joints and lameness from various causes." This late eminent surgeon was for many years Professor of Surgery at Oxford; his skill and reputation became so great that he was soon in possession of all the surgical practice in that city, and on every side of it within a radius of thirty miles. No doubt, Mr. Grosvenor was a remarkable man, for he rendered himself celebrated throughout the kingdom by the application of friction for the cure of lameness and imperfections of motion arising from stiff or diseased joints. The cases in which he found the remedy most serviceable were contractions of the joints attended with languid circulation and thickening of the ligaments, and in those cases in which there was too great secretion of the synovial fluid in joints; in cases of chorea combined with attention to the system after violent strains of the joints; in incipient cases of white swelling; after fractures of the articulating extremities of the joints when stiffness remains after union; in cases of dislocation of the joint when the motion is impaired some time after reduction.

In the year 1812 a gymnastic system was introduced by Pehr Henric Ling, which is known as the Swedish Gymnastic Cure, and he was permitted by the Swedish Government to found a Gymnastic Institution at Stockholm, in the year 1813. Ling, in a work entitled "Gymnastikens Allmäna Grunder," declares life to consist of the blending together of three elements, the dynamic, the chemical, and the mechanical—

which, through their opposite action, produce variety in vital phenomena. As soon as one of these elements is deficient or diseased, a means of cure belonging to the same category should be chosen, either to restore the balance or the healthy condition. The means of cure for the mechanical element is gymnastics. According to the object to be attained, Ling divides gymnastics into the scholastic, medicinal, and æsthetic. The forms of movement which are to be employed are the active, the passive, and the compound. In this last consists the principal peculiarity of Ling's system. The active movement is performed exclusively by the will of the individual exercising. In the passive movement, a second person, the gymnast, conducts the movements of the body of the patient or pupil, who neither assists nor opposes. In the compound movements an alternate influence is exerted by both patient and gymnast, for either the patient performs a movement to which the gymnast opposes an equal resistance, in such a manner, however, that he does not completely hinder this movement, but only renders necessary a greater degree of power to effect it (compound concentric movement), or the gymnast conducts the movement of the patient's limbs, while the patient opposes a resistance in accordance with his strength (compound eccentric movement). Gymnast and patient thus alternately operate, in the first case the patient, and in the last the gymnast, gaining the ascendancy in turns. A special direction is, that the movement as well as the resistance should uniformly commence and subside gradually, so that no sudden, violent, or tremulous movement from excessive effort should occur.

In 1870, Dr. N. B. Emerson gave a very interesting account of the *lomi-lomi* of the Sandwich Islanders. He describes it as a luxurious and healthful form of passive motion which the Hawaiians bestow upon each other as an act of kindness, and their crowning act of generous hospitality to a well-behaved stranger. When footsore and weary in every muscle, so that no position affords rest, and sleep cannot be obtained, it relieves the stiffness, lameness, and soreness, and soothes to sleep, so that unpleasant effects of excessive exercise are not felt the next day; but in their stead a suppleness of muscle and ease of joint entirely unwonted. The Hawaiians have an appreciation of the physiological wants of the wearied system which Dr. Emerson thinks it would be well for the people of other civilized nations to imitate. They have various ways of administering the *lomi-lomi.* When one is about to receive it he lies down upon a mat, and is immediately taken in hand by the person who *lomi-lomies*, generally an elderly and experienced man or woman. The process is spoken of as being neither squeezing, kneading, nor rubbing, but now like one and now like the other. The Hawaiians are a famous race of swimmers, and to a foreigner they seem amphibious. When wrecked, they sometimes swim long distances, and if one of their number becomes exhausted, they sustain him in the water and *lomi-lomi* him at the same time. Dr. Emerson attributes the superiority in physique of the chiefs over the people to the fact of their having themselves constantly *lomi-lomied.* In recent times, Dr. Weir Mitchell, of Philadelphia, has brought the Massage System into use, and shown the great advantages which it possesses in the curative treatment of disease. He has given very valuable testimony by his writings concerning Massage in certain cases of anæmia and bed-ridden women, and much evidence of the value of this remedy is now to be found in the medical journals all over the world.

I have been lecturing upon and practising massage for several years, and I venture to think that I have from personal experience learned much in reference to this subject. I have certainly gained information concerning its nature and its effects which is not to be found in any published work, and even now I feel that an extended experience is still required to put it upon a satisfactory and a safe footing as a Therapeutic agent. Those who have had large experience cannot question its utility.

LECTURES ON
MASSAGE AND ELECTRICITY.

LECTURE I.

THE PRINCIPLES OF MASSAGE.

Mechanical Principles of Massage, Kinetic, Dynamic, and Static—Pressure—Motion—Mass—Work and Energy—Potential Energy—Metabolism—Convertibility of Forces—Phenomena of Life—Transformation of Energy—Transference of Energy—Dissipation of Energy—Laws of Pressure—Nature of Pressure—Physiological Effects of Massage—Life the sum of Antagonistic Actions—Huxley on Living Matter—The Human Body an Organism—Derivation of Energy for the Animal World—The Effects of Massage as a Therapeutic Agent—Effects of Massage upon a Paralyzed Limb—Conversion of Potential into Kinetic Energy by Massage—Weir Mitchell—Massage Assimilative Processes—Cold and Heat in Nutrition—Body Temperature—Dr. McAlister on the Nature of Fever—Thermogenesis—Mechanism of Respiration—Stability of Temperature—Foster on Body Heat—Fick on Muscular Work—The Muscles as Furnaces of the Body—Dr. Meade Smith and Dr. Sukjanow on Muscular Fatigue—Dr. Latham on Metabolism in Gout, Rheumatism, and Diabetes—Sir Dyce Duckworth on Gout as a Neurosis—Action of Vaso-motor Nerves and Blood Vessels, in Nutrition, Assimilation, and Excretion—Dr. Latham on Imperfect Metabolism—Circulation of the Blood and Functional Activity—Physiological Processes subservient to Massage—High Tension, Low Tension, Variable Tension—Dr. Richardson on Animal or Vital Mechanics—On the Gaseous Constituents of the Blood in relation to Respiration—Views of Johannes Müller, Spallanzani, Levoisier, Lagrange, Sir Humphrey Davy, Liebig, Regnault, Fernet, Professor Stokes, Matteucci, Claude Bernard and Paul Bert—Zabludowski On the Effects of Massage on Healthy People—Schreiber On the Effects of Massage.

MECHANICAL PRINCIPLES OF MASSAGE.—The principles of massage movements are in their nature kinetic, dynamic, and static; and the mechanical movements associated with the various massage manipulations are formulated in their kinetical, dynamical, and statical order.

We know that we become conscious of matter whenever we meet with resistance. Therefore, to anything able to produce in us this sense of resistance, we apply the term matter.

In Professors Thompson and Tait's great work on Natural Philosophy (Part I., Division I., Chap. xi., p. 173), the following account of matter is given: "We cannot give a definition of matter which will satisfy the metaphysician; but the naturalist may be content to know that matter is that which can be perceived by the senses, or is that which can be acted upon by, or can exert, force."

The latter, and indeed the former also of these definitions, involves the idea of Force, which, in point of fact, is a direct object of sense, probably of all our senses—and certainly of the muscular sense.

All that we know about matter relates to the series of phenomena in which energy is transferred from one portion of matter.

The process by which stress produces change of motion is called work; and work, as we know, is the transference of energy from one body or system to another.

The effecting of changes in matter is working, this being a process performed against opposing forces. It is in virtue of its possession of so much energy—a measurable thing—that any body does work, *i.e.*, produces changes against force.

Pressure plays an important part, as we shall see, in the different massage movements. It is unimportant whether the pressure be applied to mass or to molecule, so that we are concerned with molar movements, as well as with molecular motion.

Further, the forces or energy applied must be equal to the molecular resistance to be overcome. In consequence of this, we have to deal with motion, mass, and force.

Motion must be considered with regard to change of position; *Mass* with respect to the quantity of matter; and *Force* relatively to its production of the motion of mass.

Hence the amount of force must be equivalent to the quantity of mass, and its resisting power. This leads us to the consideration of *Work* and *Energy*.

Energy signifies capacity for work, and its possession by the body, or system of bodies, bestows the capability for activity. Motion, therefore, including the ordinary molar motions of translation or rotation, and molar molecular motion of undulation; heat, electricity, and magnetism, are forms of energy.

To this may be added strain (including compression), extension, distortion, gravitate separation, as well as chemical separation, and, possibly, *Vital Energy*.

A careful distinction must be drawn between the energy of the body not doing work, and the energy of the body that *is* doing work; for, since energy is the possession of the capacity for activity, it is evident that a quiescent body may yet have energy.

This latter energy would be of a potential or static kind, implying that no work was done, or space traversed, by the body possessing it. On the other hand, we speak of kinetic energy, as the energy of the active body, or, in other words, actual, as distinguished from potential energy.

Potential energy exists in virtue of the force of cohesion or gravitation. It is this definite and indestructible supply of potential energy that is the real thing, of whose exertion the force is but an indication; it is those potential energies of nature which are the real element which seems to survive in association with matter, which gives it its appearance of substantiality, and which is revealed to us whenever, as we say, we press against, or force is exerted in relation to, any particular body, in which case what really takes place is the transmutation of a certain amount of this potential energy into kinetic or otherwise. So that it is after all only a revelation of existing potential energy by a transmutation thereof into kinetic, which takes place when, as we say, a material body is discovered to the muscular sense.

In passive gymnastic exercises (which form an important part of my massage system), the patient's energy is in a potential or static state, as compared to the energy of the masseur, which is in an actual or kinetic state. The exchange of matter and energy peculiar to living beings is known as *metabolism*, and consists in the capacity of organisms to assimilate the matter of their surroundings, and to work it up into their own constitution, so that it forms for a time an integral part of the living body, and is the outcome of vital action or vital and physical motion.

Physical science has now ascertained that the phenomena with which it deals are only different modes of a common energy. Heat, light, electricity, magnetism, etc., are but different modes of motion produced under different conditions, and they are all, either directly or indirectly, convertible into each other; and modern investigation tends to resolve chemical into mechanical problems, that is, into questions of molecular physics. As we advance from the inorganic to the organic world, we find that science has not yet been able to trace the production of vital phenomena to the operation of physical or chemical agents; and yet we have strong presumptive proof that life is transformed physical energy, and that the energies of the animal frame, muscular, nervous, and so on, are resolvable into molecular force. Professor Gardner, at the meeting of the British Association, at Bath, 1888, pointed out that in the living substance the most gigantic changes and evolution of energy appear to be affected by the action of delicate reagents. With regard to the question of vital force, he found considerable difficulty in thinking of protoplasm as a substance. He was of opinion that the phenomena of life consisted in an infinite arrangement and rearrangement of an exceedingly complex system of molecules, and that protoplasm would ultimately be found to be the development of energy and nothing tangible.

All phenomena, however apparently different, are reducible into forms of *motion*, light into heat, heat into chemical energy, chemical energy into electricity, and so on, so that these are only various forms of that energy which are convertible into each other, and each is the exact quantitative equivalent of that from which it has been converted: amongst the endless transformations which manifest themselves in the phenomena of the material world, there is not the faintest quantity of energy ever abstracted or dissipated, nor the faintest addition to the grand sum ever made. In every voluntary action, an equally arbitrary increase, or an equally arbitrary restoration of the sum of energy takes place.

The whole series of phenomena (metabolic), consists in the introduction, assimilation, integration, and excitation of matter, life processes having, in fact, a dynamic basis.

It must be borne in mind that potential energy can be converted into kinetic, and kinetic into potential.

The transformation of energy is necessarily attended by the diminution of its availability. Molar energy thus becomes molecular, and the transference of energy is always accompanied by the dissipation of energy.

Hence it must be clear and evident, even to the uninitiated, that massage processes, from the merely mechanical point of view, possess an interest, and are associated with the accomplishment of some of the highest and most complex transmutations and transformations of energy. The consideration of this leads us to the true dynamical outcome or value of such terms as *petrissage* and *tapotement*.

The clear interpretation, and intuitive perception, by practice, of the value of dynamical changes, brought about by, or associated with, massage processes, are undoubtedly of much value and significance to the masseur.

Force applied to living matter causes, or tends to cause, the motion of masses, or, it may be, of molecules, of which the living mass is composed, assuming the living matter to be made up of solid, liquids, and gases. We must take into account the laws of pressure and its area of distribution, as well as its intensity upon the organism upon which its influence is exerted. We must distinguish between the amount of pressure and the intensity of pressure. Quantity and intensity of pressure are analogous to the quantity of heat in, and the temperature of, a body.

Pressure applied is transmitted variably, according to the resisting power of the tissue to which it is applied,—to its vitality,—and to its mass.

Pressure of given quantity deranges molecular integrity, alters equilibrium, and so engenders irritability and instability. Pressure of given intensity produces molecular inertia and death. This will be found referred to when writing of the influence of pressure, pinching or petrissage movements, as applied to the living tissues. According to the nature of the pressure applied and the resisting power of the tissue operated upon, so do we get changes in such tissue of molecular activity and irritability, or molecular derangement and death.

We have seen that motion in all its forms is, as far as we know, convertible but indestructible, that heat is a mode of molecular motion, that the phenomena of light, of electricity, of magnetism, of chemical action, and probably of life itself are due to different modes of molecular motion.

If a piece of copper and a piece of zinc are placed in dilute sulphuric acid, the zinc begins to dissolve (chemical action). Two copper wires attached, one to the end of the piece of copper out of water, the other to that of the zinc, are found to be "carrying an electric current" (electricity). If the free ends of the two wires are brought sufficiently near one to the other a spark leaps from one to the other (light). If the two wires are joined they are of a higher temperature than they were before the experiment began (heat). If a single connecting wire is wound round a piece of soft iron, the latter is found to have acquired the property of attracting iron filings (magnetism). If the two free ends of the separate wires are applied to a muscle and the nerve connected with the muscle, of a recently killed frog, the muscle contracts (physiological action). And if, finally, the two free ends are dipped into acidulated water, the water is decomposed into hydrogen and oxygen (chemical action again). This experiment, and innumerable others of a similar nature, show that the various forms of motion are convertible one into the other. Further, they are numerically convertible, and, with due care in the conduct of the experiments, it is found that for every grain of zinc dissolved, a definite corresponding quantity of any one of the other modes of molecular motion is forthcoming. So, also, when the molar motion of the cannon ball or of a cabman's arms on a winter's day is converted into the heat of a target or body there is no actual loss.

Before leaving the subject of mechanics in reference to massage, I must just call your attention to the consideration of force in association with mass and weight. We know that force is that which causes or tends to cause motion. In merely effleuraging or stroking the surface of the body, or petrissaging, or kneading and energizing the muscular and deeper tissues, we are effecting by force molar and molecular motions in the parts, and we have to calculate the amount of force which is required to overcome the resistance which the tissues offer according to their condition and according to their vitality and susceptibility, this clearly becomes a very important matter for consideration. When a force causes the motion of a mass, it denotes, and the work accomplished in a given time is called, power. The masseur working, say at the arm of his patient, energizes the tissues by the force which he expends being converted into motion, and the resistance overcome will be equivalent to the force transmitted. The work done must be equivalent to the power employed. If the work be properly effected, there can be no creation and no destruction, either of matter or motion. It is only the conversion of motion into another form or phase. We will say, for instance, a force F cuts against and overcomes a resistance R, the work done by F must equal the work done by R. If $Fd = Rd$ d and d represent the respective distances through which F and R work, $Fd = Rd$ and $\frac{d}{d} = \frac{F}{R}$, or the distances moved through by each force are inversely as the forces. Pressure, as we employ it in petrissage, gives rise to stress and tension; for instance, when two forces act and react upon a body or upon a particle, they are together called a stress. Their effect upon that which is acted upon is a strain. Stress and strain are correlated as the active and passive phases of the same phenomenon or as cause and effect. If the force acting and the force reacting tend towards each other, the stress is a pressure; if they tend away from each other, the stress is a tension.

From what I have said concerning the leading principles of mechanics, kinematic and dynamic, you will, I hope, see that these are essentially associated with the science of motion and the science of force, as applied to the operative procedures of massage, which we know by the terms Effleurage, Petrissage, Tapotement and Friction.

Physiological Effects of Massage.—I will now call your attention to points of greater interest, namely, to the effects of these mechanical processes by massage upon the human body, upon the living tissues which are constantly and unceasingly transforming forces, forces of which we know something, and forces of which we know nothing. But this cosmic conception of physical and vital forces bound up in life organization, and the subjective phenomena of existence, involves material for thought and speculative theories which are within as well as without our present knowledge of physiology, and all we have to deal with, in fact all that we can deal with here, must be that which the science of life and disease is constantly imparting to our observation by means which are well within the grasp of every practical physician. Life is the sum of antagonistic actions, and interactions, of internal properties and external agents, "The evolute potential of vitality." Death is the dissolution, the catalysis, disintegration and degeneration of evolute processes brought about by what is termed disease, the result of the action or influence of chemical irritants upon tissues more than they can bear. Foster has shown that there is the most superficial distinction between the normal, the abnormal, the healthy and the diseased. Huxley, in writing of living matter, says that "it is characterized by its innate tendency to exhibit a definite series of the morphological and physiological phenomena, which constitute organization and life." Healthy life is dependent upon correlation of force, which is demonstrated to the physician's view as "normal functional activity!"

Landois and Stirling say, that "The human body is an organism in which, by the phenomena of oxidation, the complex nutritive materials of the vegetable kingdom, which are highly charged with potential energy, are transformed into simple chemical bodies, whereby the potential energy is transformed into the equivalent amount of kinetic energy (heat work, electrical phenomena). All food for the animal kingdom is obtained, either directly or indirectly, from the vegetable kingdom, and the three chief representatives of food stuffs, besides water and inorganic constituents, are fats, carbohydrates and proteids. Plants absorb the kinetic energy of light from the sun's rays and transform it into potential energy, which is accumulated during the growth of the plant in its tissues, and in the food stuffs produced in them during their growth. Animals are living beings, which, by oxidation, decompose or break up the complex grouping of atoms manufactured by plants, whereby potential is transformed into kinetic energy. Thus, there is a constant circulation of matter and a constant exchange of energy between plants and animals. All the energy of animals is derived from plants, all the energy of plants is derived from the sun, thus the sun is the cause, the original source of all energy in the organism, *i.e.*, of the whole life." We shall see directly how valuable massage is in bringing about the oxidation and metabolism of tissue, and the conversion of potential into kinetic energy, particularly in those cases of paralysis and nervous exhaustion where oxidation and respiration of tissue are at their lowest ebb. Massage does what no other therapeutic agent can do, that is, brings into activity potential energy, restores the normal to the abnormal, maintains stable equilibrium of force. For instance, massage will promote the development and growth of fat. It also arrests its development and promotes its absorption. I always illustrate this apparently anomalous fact to my class in this way:—If a patient is by heredity lean, and he puts on fat abnormally, massage will bring about its absorption. If, on the other hand, a patient should by heredity be fat, and he becomes lean, massage will in him promote the rapid development of fat: *organic disease always excluded.*

If any excuse be needed to warrant and to justify my warmly advocating my system of massage, it is to be found in the simple fact, that my experience has proved it to be an agent of great regenerative power, an agent whose beneficial influence has not yet been duly appreciated, and an agent whose curative powers are most marked in those cases where other agents have signally failed to bring about a cure. Unfortunately for the great science of medicine it has no law. Effects are seen, causes are unknown. The more we study the simplest laws of nature in reference to functional activity, the more able shall we be to aid her when those functions are deranged.

The secret of the success of any remedial agent depends entirely and absolutely upon the knowledge we possess of its definite and precise range of action under varying and variable conditions. Nothing but the most careful study of details can ever lead us to a successful issue.

If we study carefully the effect of massage upon a paralyzed limb, say the paralyzed leg of this child suffering from ant. polio myelitis, we shall see that several notable changes are brought about. Some are objective and some are subjective. We are now considering the local effects only. They are increased temperature and change of colour from that of lividity to a bright red. These changes are of course associated with increased oxidation, increased molecular activity, and increased sensibility, and metabolism. This morning I took the temperature of this child's limb very carefully at the inner part of the leg (the temperature of the ward being 64° F.) and I found it was below 70° F. After ten minutes manual petrissage the temperature of the limb had risen no less than 17° F. That is to say, the temperature before massage was under 70° F and after massage it was 87° F. We cannot over estimate the value of this increase of temperature. It indicates, as I have just said, (especially when associated with a red healthy hue) increased metabolism and respiration of tissue. The reaction to the galvanic current before and after massage, in this form of paralysis, is of great interest. In this little child's legs that I now exhibit to you we have a common instance of the usual reaction to faradization and to galvanism. In infantile paralysis, during the acute stage of degeneration, we find an hourly decreasing response to the faradic current, until in three or four days the muscles entirely cease to respond. At this time we find in all probability that the nerves have ceased to respond to the galvanic current, but the muscles respond to a less current than in health (myotatic irritability). When this child first came under my care, the reaction of degeneration was well marked, but by massage and galvanism the motor cells of the grey matter of the anterior horns of the spinal cord have gained by redevelopment compensatory power, and we now find, instead of an absence of muscular response to both galvanic and faradic currents, there is decided activity in both muscles and nerves to either current, though more to galvanism than to faradization, But what I am anxious to show is this: You see I apply the electrodes of Stohrer's battery to the limb, and the galvanometer indicates that eleven milliamperes current strength are required to produce muscular response, the temperature of the limb being 70° F. I now massage and I raise the temperature to 95° F, a rise produced by massage of 25° F. I now apply the electrodes to the limb, and if you watch the needle of the galvanometer you will see that instead of eleven milliampères only five are required to bring about muscular response. This is objective evidence of the most decided kind that massage lessens the resistance and increases the vitality of the limb.

The primary influence of massage is essentially mechanical, producing effects which are purely physiological. It matters not whether the influence is such as can be obtained by stroking, pinching, hacking, percussion, or vibration.

Our first object is to obtain results by induction through the nervous system by peripheral nerve agency—superficial reflexes are always induced by stroking and friction movements.

Our second object is to combat and overcome resistance (nervous or circulatory) by direct pressure, pinching and kneading.

Our third object is to promote due oxidation and respiration of tissue by percussion and vibration.

Whatever terms we employ, or whatever divisions we arrange, they must be looked upon as arbitrary, artificial, and used merely for the sake of convenience and demonstration. To sum up, the results of massage are essentially vital, for by them undue stress, tension, and pressure in the tissues are overcome, the natural antagonism between constrictor, dilator and trophic nerves is established, the governing influence of the central nervous system is stimulated and relieved of inhibitory and fettering influences. Endosmosis and exosmosis have free and fair play. Catabolism and anabolism assume a normal level of correlative stability, and thus we ensure the natural functional activity of the processes of secretion, excretion, absorption and assimilation, in fact, healthy nutrition. The chief condition which regulates the absorption of oxygen is temperature. I refer to absorption of oxygen by tissue (tissue respiration) rather than to pulmonary respiration. In reference to temperature it must be admitted that blood seems to have a greater capacity for absorbing oxygen in cold countries, but heat (which is one of the first effects of massage) is absolutely necessary for respiration and oxidation of tissue.

I take a piece of tissue thus between my finger and thumb, and I petrissage lightly this tissue by rolling and pinching it, and the first effect which I produce is to increase the temperature and the activity of the circulation. I convert the potential energy of the part into kinetic energy with the result that its vitality is augmented. If I increase the pressure I increase the sensibility, and if I continue to increase the pressure, which I can do beyond the point of extreme vitality, I produce a condition below the normal range of vitality, I destroy the integrity of the vaso-motor nerves, the circulation is interrupted, possibly destroyed, with the processes and forces of vitality which are inherent in the tissue. The result is that molecular disintegration, degeneration and mortification follow. I not infrequently hear people say that massage is a cruel process, that they have been made black and blue by the operation; this is of course very dreadful to contemplate, for such massage as this is the very opposite to what skilful massage should be, and may be productive of irretrievable harm.

Massage, like every other form of treatment, is doomed to discredit, because it will be often applied in those cases to which it is ill adapted.

The various processes of massage are of a purely dynamical character, but in order to demonstrate the nature of these processes to you, I must first ask you to allow me briefly to bring before your notice the physiological changes which are brought about by their action, and I hope I shall make it clear to you (as it has for a long time appeared clear to me) that massage has a potentiality of the highest physiological order. Every practical physician knows perfectly well that the treatment of so-called functional diseases requires great patience on his own part, and also on the part of the patient. Many a person suffering from functional derangement becomes a chronic invalid through his impatience and his want of confidence in the physician or the mode of treatment. Hence he runs about from one doctor to another, vainly endeavouring to find an immediate cure for all his woes, and finally, the last state of that man is worse than the first. If massage is to be successful as a remedial agent it must not only be dexterously and skilfully administered, but it must be carried on for a definite, and, in some cases, for a prolonged period of time. There can be no doubt that we are greatly indebted to Dr. Weir Mitchell, of Philadelphia, for having of late years brought this plan of treatment into practice. I quote his own words as follows: "This form of treatment by massage has been fruitful in cure, and affords numerous instances of success, which are in truth living records of the failure of every other rational and many irrational plans, and comprise a large number of people who are kept meagre and anæmic by constant dyspepsia in its various forms, or by those defects in assimilative processes, which, while more obscure, are as fertile parents of similar mischiefs."

I will now solicit your attention to what we might call massage assimilative processes, and I must bring this subject before you under the heading of metabolism, and give you my physiological reasons why, in my opinion, massage has a scientific as well as a physical aspect for our consideration. We cannot well comprehend the action of any remedial agent unless we know what are the chemical changes which take place in nutrition, secretion and disintegration, forces, in fact, which determine the building up or destruction of tissues, and the actions and reactions of the atoms and molecules which enter into their composition. Now these changes and interchanges, which are constantly active in all healthy tissue, are known as metabolic changes, and if I am right in my conclusion that the great object and aim of massage is to bring about these changes and to raise them to a healthy standard when they are defective, I must ask you to bear with me for a short time whilst I endeavour to lay before you some points of interest in reference to this part of my subject. The paralyzed limb of the child to which I have before referred, gives us an opportunity to further consider the great question of heat in reference to nutrition, to metabolism, and to the circulation. Cold has a markedly depressant action in nutrition. Heat, on the other hand, is favourable to nutrition, inasmuch as it is favourable to the due metamorphosis of tissue. Therefore, energizing muscle by massage induces metabolism and promotes nutrition. But we must remember that disorder of the body heat implies disorder of the circulation, of the respiration, of the digestion, of secretion, and of the nervous and muscular systems. The due maintenance of the normal temperature of the body under varying conditions and opposing tendencies is of the utmost importance, and is worthy of serious consideration to all those who are interested in massage. I may tell you at once that it would be the height of folly to place a patient under a course of massage when the circulation was active and the temperature normal, unless it were for some local defect or localized pain. We shall therefore be much better able to comprehend the physiological effects of massage after we have well considered the sources, nature, and effects of heat in reference to the human body. In health the stability of temperature is nearly perfect. Dr. McAlister in the Gulstonian Lectures, "On the nature of Fever," delivered at the Royal College of Physicians last year, has taught us a great deal concerning the question of heat, and I am indebted to these lectures for much information upon this subject. (1,) There must be a source in the body from whence heat is produced (thermogenesis). (2,) There must be processes by which heat is discharged from the body (thermolysis). (3,) There must be a mechanism by which the heat production and the heat loss are balanced at the normal height. This is called the *thermotaxic mechanism*, and controls in health the *thermogenic tonus*, which means a balance between the liberation of thermal energy, on the one hand, and its repression on the other; in fact, it regulates the body temperature and gives it stability, and just as the governor of a steam engine regulates the speed, it must of necessity govern and regulate both heat production and heat loss, and is the highest and most important factor of the three. We can know more of thermolysis than we can of thermogenesis by studying the main channels by which heat passes out of the body, namely the skin and the lungs. Through the skin there escapes, by evaporation, conduction, and radiation, more than 80 per cent. of all the heat discharged from the body, the remaining 20 per cent. escapes through the breath. The rate of heat loss varies just according to the vascularity of the skin, and it also of course varies according to the amplitude of the respirations. A face flushed with wine feels warm, for it is rapidly discharging heat; a dog whose skin lets little heat pass through it pants to cool itself. Now, with reference to the circulation, we are well acquainted with the fact that the calibre of the arteries is kept constant by the two kinds of vaso-motor nerves arising in the brain and spinal cord, and which are called vaso constrictor or motor and vaso dilator or inhibitory.

With reference to respiration, we find that it also is governed by a nervous mechanism controlled by centres in the medulla oblongata and spinal cord, with a two-fold complement of nerves proceeding to the respiratory muscles, the one motor and active, the other inhibitory; and we believe that the respiratory centre consists of two correlated parts, the one subserving inspiration and the other subserving expiration. We thus find that the two channels of heat dissipation are under the control of double acting nervous mechanisms, each having a motor and an inhibitory aspect, and from these postulates we might draw the deduction that the temperature of the body in health is maintained by the vigilant action of the sensitive nerve centres, which control the great systemic functions of circulation and respiration.

When we get an undue or unequal distribution of heat to different parts of the body, we get from some cause or other a disorder of the thermotaxic mechanism ; a fluctuation, so to speak, between thermogenesis and thermolysis, due to defective metabolism. So much for heat discharge. I must now refer you to thermogenesis or heat production. The temperature of the body is merely a function of the difference between heat income and heat expenditure at any moment. The stability of temperature (by which I mean the integrity of the thermotaxic mechanism) is merely a question of tonus or health. None but the invalid and the physician can say how variable, and how suddenly and rapidly variable is this state of thermogenic tonus.

Thermogenesis is necessarily associated with chemical processes in living tissue, and, as I maintain that the processes of massage, when curative, are due to their power of inducing thermogenesis, I must ask you to kindly bear with me whilst I endeavour to elucidate this subject a little more fully. What, may I ask, is the tissue wherein thermogenesis is most active ? In the first place we know that muscle forms about one half of the substance of the body, and that the mean rate of oxidation in the muscles is higher than that of the average of all the tissues, and we are therefore justified in coming to the conclusion that the muscles are the chief contributors to the heat of the body. Professor Foster, in his well-known work on Physiology, says :—" We may at once affirm that the heat of the body is generated by the oxidation of the tissues at large by respiration of tissue. Wherever metabolism of protoplasm is going on heat is being set free." . . . . In growth and in repair, in the deposition of new material, in the transformation of lifeless pabulum, in the constructive metabolism of the body, heat may be undoubtedly to a certain extent absorbed and rendered latent, the *energy* of the construction may be, in part at least, supplied by the heat present. But all this, and more than this, namely, the heat present in a potential form in the substances themselves so built up into the tissue, is lost to the tissue during its destructive metabolism, so that the whole metabolism, the whole cycle of changes from the lifeless pabulum through the living tissue, back to the lifeless products of vital action, is eminently a source of heat. Fick calculates, from actual observation, that during severe muscular work the quantity of exhaled carbonic acid may be five times the normal, showing that of the total energy derived from the food, one sixth goes to the work and five sixths to the extra production of heat that accompanies it. The muscles, then, are looked upon as the furnaces of the body, and are estimated to contribute in health four fifths of the body heat. From the investigations of Dr. Meade Smith and Dr. Sukjanow, (see "Du Bois Reymond's Archiv," 1888), concerning the laws which govern the fatigue of the thermogenic function of a living muscle, we have some highly interesting conclusions, which I might say are of very great importance to the student of massage. (Please understand me, I do not mean the medical rubber or the joint man or the bone setter. I mean the scientific practitioner of medicine). Let us see what these conclusions are. If a muscle is stimulated through its nerve, two processes are set up, one manifested by change of form and the performance of mechanical work, the other manifested by the increased development of heat. And each process appears to have its own laws as regards (1,) The influence of external conditions, such as intensity of stimulus; (2,) The influence of fatigue from repeated stimulation; (3,) The influence of general exhaustion from inanition or other debilitating cause; (4,) The influence of the general temperature of the protoplasm of the muscle; and (5,) The influence of rest and the circulating blood in restoring lost power. Now, if I wanted a text upon which to preach a massage sermon, I could not possibly find one more appropriate than these conclusions of Dr. Meade Smith and Dr. Sukjanow. Every point seems to me to have a direct bearing in relation to those cases of nervous exhaustion, prostration, feebleness, and malassimilation which we know recover so rapidly under the influence of massage and appropriate feeding. Then normal metabolism is dependent upon a balance between the nervous impulses subserving anabolism or the building up of tissue and the integrity of the assimilative processes, and catabolicism or the unbuilding, disintegrating and destructive processes. I must now ask you to follow me a step further and consider metabolism from its pathological aspect, taking as types of disease, rheumatism, gout and diabetes.

I suppose there is no man living who has applied the science of Chemistry with greater skill and dexterity than Dr. Latham, of Cambridge, to formulate an assumptive basis upon which to connate the series of changes associated with the chemical metabolism of tissue in such diseases as gout, rheumatism, and diabetes. Dr. Latham, in his original and, I might say remarkable Croonian lectures, which he delivered at the Royal College of Physicians, in 1886, " On some points in the Pathology of Rheumatism, Gout, and Diabetes," says that he classed these three diseases together because they seem to possess a certain relationship with each other. Not infrequently transient diabetes appears as the harbinger of a gouty attack, and, on the other hand, gouty, rheumatic or neuralgic pains are very common accompaniments of diabetes. In all we have changes (differing however in character), showing themselves in the blood, the result of abnormal metabolism either in the muscular or glandular tissue. But, as Dr. Latham acknowledges, we know nothing of the proximate elements which make up living tissue, nor what are the chemical changes which take place as it performs its function, nor the alteration in the arrangement of its molecules as it passes from an active to an effete state. So that many of Dr. Latham's chemical groupings, as he candidly admits, must be in a measure pure hypothesis; but, whether they be hypothetical or not, the practical outcome is of vast chemical, physiological, and pathological importance, and although not proven to-day, will, I venture to think, as science advances, be removed from the realm of hypothesis to that of physical fact.

Do not think, if you please, that I am leading you away from scientific massage. On the contrary, I am endeavouring to claim your attention to these changes going on in the tissues of the body, simply and merely to show you that where these changes are defective, we can, by massage and appropriate dietary, very often bring about a normal condition of things, a stability, and, in fact, a tonus which is alone compatible with a state of health. I think the day is not far distant whe nyou will find this form of treatment an absolute cure for diabetes. In several cases where I have prevailed upon patients to try it for six weeks with appropriate diet, every trace of sugar has disappeared, and the urine has resumed its normal specific gravity. And if gout is (as Sir Dyce Duckworth maintains) a primary neurosis due to some instability of the trophic nervous system, having its origin in the medulla oblongata, there can be no doubt whatever that diabetes takes its origin from a similar source. I do not think that we need go to the medulla oblongata for every form of defective metabolism; vaso-motor centres are distributed throughout the whole spinal axis, and I believe they are excited reflexly by massage processes. Of course it is only reasonable to conclude that the dominating and controlling centre is in the medulla oblongata, which is really a complex composite centre consisting of a number of closely aggregated centres, each of which presides over a particular vascular area. Now, what does Dr. Latham say about this? I really must give you his own words because they are so entirely in accordance with physiological and clinical experience.

"Some of the nerve cells or some portions of this dominating centre in the medulla oblongata may be more readily exhausted by the continued stimulation of an irritant circulating in the blood than the others, and after the development of the irritant (uric acid) in the system, it will of course produce exhaustion just in these particular cells, and in the subsidiary ganglia in connection with them, and so lead to the dilatation in the vascular area directly under their control. The other unaffected cells in the dominating centre in the medulla oblongata, and the subsidiary ganglia in connection with them, possessing a healthy tone, will be stimulated to action in the normal manner, and contraction will take place in the vascular areas connected with them. This action itself would have the effect of driving more blood to the paralyzed vascular area, and intensifying the symptoms there. But with continued stimulation of these healthy centres exhaustion will sooner or later be induced. These points of nerve physiology are of great interest, as showing and explaining how pathological conditions may and do arise from defective nervous action, giving rise to exhaustion and defective correlation. The most powerful vaso-motor nerves are those which act upon the blood vessels of peripheral parts, while those that act upon central parts are less active. In addition to contraction of the vessels, caused by impulses affecting the blood supply, there are impulses affecting directly the activity of the protoplasm, so that the constructive metabolism (about the joints, for instance) is stimulated, whilst the blood supply and destructive metabolism are lessened, and so there is increased development or growth about the part."

I cannot leave the question of metabolism without once again drawing your attention to the important part which the dominant vaso-motor centre in the medulla oblongata plays in the great processes of nutrition, assimilation, and excretion: processes which we believe to be so essentially influenced by massage. We have, I think, clearly proved that metabolism is both constructive with vascular dilatation, and destructive with vascular contraction; that it is governed by two sets of nerve fibres, in like manner to those which govern the blood vessels, respiration, and the movements of the heart, and that they enable, as far as possible, the two great processes of waste and repair to be maintained in a given ratio, subserving definite tissue metamorphosis which is compatible with health and a vital tonus, and which is the secret of success in the massage processes. We cannot consider the processes of digestion and assimilation without noticing the important part which this dominant vaso-motor nerve centre takes in the metabolic function of the liver. The duty of the liver is to secrete bile from the blood which contains the products of digestion, and the nature and quality of the blood will depend upon the kind of food which has been taken, and we are led also to believe that the quality of the bile must in a measure be similarly influenced, so that according to the constitution of the portal blood must be the integrity or otherwise of the metabolic function of the liver, which, moreover, is dependent upon the absorption and transformation of certain constituents of the blood by the hepatic cells, controlled of course by the secreting nerve fibres in connection with these cells—(entirely independent of the nervous mechanism controlling the vascular supply). If there be defective correlation between the vascular dilatation on the one hand, and the hepatic function of the liver cell on the other, there will be imperfect metabolism, giving rise, as we know, to sugar as in diabetes, and to uric acid as in gout; for I think we must admit that there are various nerve filaments responding to various kinds of stimuli, some regulating the transformation of saccharine products, the other the nitrogenous elements conveyed to the cells by the portal circulation.

Dr. Latham says that "Imperfect metabolism results if too much nitrogenous material is introduced into the portal vein from the alimentary canal; the portion then which is least readily acted upon (namely, the glycocine) will not be transformed, and so the formation of uric acid is promoted. We see the same thing constantly, even when the liver is in a healthy and normal condition; if it has too much work thrown upon it, that is, if more nitrogenous material is introduced into the portal vein than can be transformed in the gland; and so an occasional indulgence at the table is very generally succeeded by an appearance of urates in the urine. If the liver cells are already exhausted by long continued overstimulation, with how much greater difficulty will the perfect metabolism of nitrogenous food be effected." The uric acid will then be formed in excess, and if not eliminated will circulate as a poison in the blood, acting as an irritant upon some portion of the nervous system, according to the sensitiveness of the nervous spot or centre in the nervous mechanism, giving rise to gout, diabetes, rheumatism, dyspepsia, cardiac irregularity, megrim, etc.

"In gout," I again quote from Dr. Latham, "as we have stated, the uric acid is the result of modified innervation of the liver or exhaustion of the hepatic cells, and so there is non-transformation of the glycocine and the consequent formation of uric acid. In rheumatism, the glycocine results from changes in the vascular area, and in the metabolism of the muscles, and along with its formation there is also the formation of lactic acid by hydration,

Both from the Cyanalcohol, $CH_2 . CH_2 \left\{ \begin{array}{l} OH. \\ CN. \end{array} \right.$

And the Cyanalcohol, $CH_3 . CH \left\{ \begin{array}{l} OH \\ CN \end{array} \right. \frac{1}{3}$

The nutrition of the joint is modified by the uric acid, but the nutrition is further modified by the presence of the lactic acid, producing dilatation of the arterioles, more particularly of those in the cutaneous area. In this manner," says Dr. Latham, "I venture to suggest, are the characteristic changes about the joints in acute rheumatism developed."

All this, and a great deal more upon kindred lines of thought, is brought forward in a very able manner by Dr. Latham in his Croonian lectures, which bristle with original hypotheses and deductions concerning the nervous origin and chemical changes occurring in gout, rheumatism, and diabetes; and if this chemical theory of the formation of uric acid by changes in the tissues, "by the conjugation of residues of glycocine with residues of urea," is to supersede the physical theory of the formation of gouty tophi as mere depositions of insoluble material, then we shall the more readily understand and comprehend the basis upon which the massage processes in gouty states are attended with such eminently satisfactory results.

The circulation of the blood is so essentially connected with the vitality of the part, with its metabolism, its heat, and its sensibility, that its importance in the rôle of the organism must be apparent and self-evident. A regularly sustained and ample supply of blood is absolutely necessary to functional activity, no matter whether it be of the nervous system, the glandular system, or the muscular system.

In the brain, for instance, functional activity and efficiency are entirely dependent upon a due supply of nutrient material and of oxygen carried to it by the capillary circulation.

The circulation, if one may judge of it by the pulse alone, either by digital manipulation or by the sphygmograph, is the most varying and variable of all functions. This can be easily conceived if we look upon the circulation as the servant and not the master; and physiologically it is tissue activity which conditions the blood, and not the blood supply which conditions the tissue changes. The heart being the centre of the circulation, determines its force, strength and regularity, all surroundings being equal, especially the elasticity of the great vessels, and the resiliency and due resistancy of the capillaries, arterioles, and ultimate tissue elements; but beyond these conditions we have, holding magisterial sway, the influence of the pneumogastric and sympathetic nerves (the sympathetic being the motor nerve keeping the cardiac ganglia in a constant state of activity, and the pneumogastric controlling or inhibiting its action).

But I wish to confine my remarks to the circulation, pure and simple, always bearing in mind that I never desire to enter more fully into the realms of physiology than is necessary to show how physiological processes of the highest order are subservient to massage. It would be impossible, however, to consider the physiology of the circulation in reference to massage, if we did not remember the omnipotency of the nervous centres and how the minutest of the minute capillary vessels are *en rapport* with its governing nerves. It is only through nerve agency that we can account for "circulation vagaries," and particularly that condition known as the paroxysmal palpitation of the heart, when the pulse rate will vary from 200 to 300 in the minute, without any actual traceable change in the structure of the heart or the vessels. What is this but neurasthenia? Anyhow, the cardo-inhibitory centre in the medulla oblongata must be involved in these conditions, and for the time being is in a neurasthenic state. Again, the circulation may be exceedingly slow and the pulse infrequent—only 40 to the minute, or, on the other hand, it may give rise to an intermittent and irregular pulse, both conditions being quite compatible with health, and even vigour, up to a fairly average age.

There are two states of the circulation to which I must draw attention, and they are high tension and low tension. But before considering these, it is well that this question should be asked and answered, namely: Can we tell from the nature of the pulse whether massage treatment will be beneficial? I believe we can. Let us consider very practically and briefly these states of tension.

Now, high tension in an artery is significant either of a great deal, or, on the other hand, it may be neurosal, or it may be hereditary, or it may be temporary and transitory, and mean very little. It may be of blood origin as in gout, kidney disease, chronic poisoning, and other conditions of the blood irritating the vaso-inhibitory nerves, producing by its influence upon the brain, medulla, and spinal cord, clonic or tonic convulsions, or positive muscular rigidity, just as it affects the higher, the median, or the lower nervous centres. By increased arterial tension, heightening internal blood pressure, an increased flow of cerebro-spinal fluid is induced by the power which is thus exercised upon the choroid plexuses.

Whatever the cause may be, the tension itself is due to an obstruction to the normal blood flow, between the minute capillaries and veins. This means, of course, resistance throughout the whole of the arterial and venous circulations; and although this resistance is at first peripheral, it eventually becomes central, and finally expends itself upon the heart. So long as this resistance is of low degree, nothing comes of it, the heart demands more nerve influence and it gets it, but this cannot go on for ever. Tension begets tension, resistance increases, function is deranged, then impaired, and finally, arrested. Heart hypertrophy, dilatation, and dropsies are the sequence. Is this, then, a condition of the circulation which may be beneficially influenced by massage? I answer most unhesitatingly in the affirmative. The pulse characteristics of arterial tension are well known, but it must not be forgotten that tension is a matter of degree, therefore we have dissimilarity of tension, varying, but co-equal with resistance; so that there may be considerable arterio-capillary tension before we can readily distinguish that solid cord-like condition of the pulse, which is usually looked upon as its chief characteristic. Cardiographic tracings, judging from my own experience, are better then sphygmographic tracings in determining initial arterio-capillary tension. Low arterial tension is perhaps of more interest to the masseur than high arterial tension, so we must for a moment inquire into the nature of the former and compare it with the latter; the comparison is definite and may be stated in a few words, namely: In high arterial tension resistance is indefinitely increased; in low arterial tension resistance is if anything diminished. In the former, the capillaries and arterioles are contracted and their calibre narrowed, so that the blood flow is impeded. In the latter, the capillaries and arterioles are relaxed, allowing the blood to flow with freedom, the heart is necessarily weak in action, the pulse will be short and weak also, so weak in fact, that it is at times scarcely perceptible. Low arterial tension reaches its maximum or minimum, whichever way you like to put it, just preceding the act of fainting, and just preceding the convulsions of epilepsy. It denotes feebleness and want of energy, defective metabolism, defective secretion and excretion, nutrition and assimilation, and general impairment of function, not of one part of the body, but of all parts of the body: the brain and nervous system more particularly being under its depressing and enervating influence. There is another condition of the circulation to which I need refer, and that is a condition of variable arterial tension of purely nervous origin, and localized in its nature, its character, and its influence. It is often reflex, and may be due to a higher nerve centre acting upon a lower, or *vice versa*, and is frequently associated with general and inherent or even hereditary instability of the nervous system as a whole. It may be looked upon as a rule as mere functional derangement, yet I have frequently met with it in the very primary stage of aortic insufficiency, therefore care must be taken to make a correct diagnosis as to the precise state of the heart under such circumstances. In massage, all the deep processes should be carried on in the direction of the flow of the venous blood and the lymph. Dr. Richardson, in one of a series of very interesting lectures, which he gave at the Society of Arts, "On Animal or Vital Mechanics," designates the veins as the true rivers of life. He says, "The circulation of blood in its primary movement begins in the veins, in a venous current which does not depend in the first instance on the stroke of the heart; but which has its origin in the digestive tract, and which supplies the heart as from a vast surface of absorption with fluid, from food and drink, and from the lymph formed in the drainage surface of the body."

The two circulations which most concern the masseur, are the venous and the lymphatic; but these will be dealt with fully in a subsequent lecture. (See Lecture VI.)

For many years I have held the opinion that the value of massage depended upon its influence in promoting respiration of tissue; but since I heard the admirable address by Prof. McKendrick, delivered in Glasgow at the meeting of the Brit. Med. Association last year, "On the Gaseous Constituents of the Blood in relation to Respiration," I am more than ever convinced that my opinion is a right one; and here I might tell you that I am strongly of the belief that respiration of tissue is essential to the life activity of all function. We will now see what respiration of tissue means. You will remember my reference to the effect upon a piece of tissue by petrissaging it. I increased both temperature and circulation in the part so acted upon, in fact I brought about or rather I stimulated respiration of tissue. And again I submit that I brought about by massage, respiration of tissue in the limb of the paralyzed child. I am sure you will pardon my wearying you with some very interesting points relating to this subject:—"Respiration may be shortly defined as the function or group of functions by which an interchange occurs between the gases formed in the tissues of a living being, and the gases of the medium in which it lives."—McKendrick.

A century ago, Johannes Müller, Spallanzani, Lavoisier, Lagrange, and several other celebrated men of that period who were distinguished in the field of science, held two theories concerning respiration; the one, that combustion occurred in the lungs or venous blood furnishing carbonic acid and aqueous vapour, which were exhaled by the lungs; the other, that there was no such combustion, but that oxygen was absorbed by the lungs and carried to the tissues, whilst in these carbonic acid was secreted, absorbed by the blood, carried to the lungs, and there exhaled. These opinions gave rise to two theories, namely, the theory of combustion and the theory of secretion. The combustion theory necessarily held its ground until Sir Humphrey Davy collected, and proved that oxygen was held in solution in the blood. At length the evidence of the existence of gases in the blood became an accomplished fact and, in like manner, respiration of tissue and the secretion theory became firmly established.

Dr. McKendrick, in speaking of the diffusion of gases says:—"In order to appreciate the value of this evidence, and the method employed (referring to his own investigations), let me direct your attention to the laws regulating the diffusion of gases. As a mass of gaseous matter has no independent form, like that of a solid body, nor a fixed volume like that of liquid, but consists of an enormous number of molecules which, in consequence of their mutual repulsions, endeavour more and more to separate from each other, it is easy to see that if two masses of gas are brought into contact they will mix, that is, their molecules will interpenetrate, until a mixture is formed containing an equal number of the molecules of each gas. The force by which the molecules repel each other, and by which they exercise pressure in all directions, is known as the pressure or tension of the gas. It is evident that the greater the number of gas molecules in a given space, the greater will be the tension of the gas, and from this it follows that the tension of a gas is in the inverse proportion to its volume (this is known as Boyle's law). Suppose now that two gases are separated by a porous partition; the two gases will mix, and the rapidity of the diffusion will vary according to the specific weight of the gases. Thus light gases, like hydrogen or coal gas, will diffuse more quickly than air, or chlorine, or carbonic acid.

It is important also to note the laws regulating the absorption of gases by fluids. If we allow a little water to come into contact with ammonia gas above mercury, the gas is rapidly absorbed by the water (one volume of water absorbs 730 volumes NH_3) all the gas above disappears, and in consequence of this the pressure of the outer air drives up the mercury in the tube. The higher the temperature of the fluid the less gas it absorbs. At the boiling point of the fluid its absorption = 0, because at that temperature the fluid itself changes into gas. The power of absorption of different fluids for the same gas and the absorptive power of the same fluid for different gases fluctuate between wide limits. Bunsen defined the coefficient of absorption of a fluid for a gas as that number which represents the volume of gas (reduced to 0° and 760 mm. barometric pressure) which is taken up by one volume of the fluid. Thus one volume of distilled water takes up the following volumes :

Temp. Cent.	N.	O.	CO_2	Air.
0	0·02	0·041	1·797	0·025
5	0·018	0·036	1·5	0·022
15	0·015	0·03	1·002	0·018
37	—	0·02	0·569	—

By the phrase "tension of the gas in a fluid" is understood the partial pressure in millimètres of mercury which the gas in question has to exercise in the atmosphere, when no diffusion between the gas in the fluid and the gas in the atmosphere takes place. The terms "pressure" and "tension" mean the same thing in pulmonary respiration. Venous blood, containing a certain amount of carbonic acid at the temperature of the blood and under a certain pressure, is brought to the capillaries, which are distributed on the walls of the air-vesicles in the lungs. In these air-vesicles, we have an atmosphere at a certain temperature and subject to a certain pressure. Setting temperature aside, as it may be assumed to be the same in the blood and in the air-cells, let us consider the question of pressure. If the pressure of the carbonic acid in the blood be greater than that of the carbonic acid in the air-cells carbonic acid will escape until an equilibrium is established between the tension of the gas in the blood and the tension of the gas in the air-cells. Again, if the tension of the oxygen in the air-cells be greater than that of the oxygen in the venous blood oxygen will be absorbed until the tensions become equal. This theory has no doubt the merit of simplicity, but it will be observed that it depends entirely on the assumption that the gases are simply dissolved in the blood. It was pointed out by Liebig that according to the experiments of Regnault and Reiset, animals used the same amount of oxygen when breathing an atmosphere composed of that gas alone as when they breathed ordinary air, and that the vital processes are not much affected by breathing the atmosphere of high altitudes where the amount of oxygen taken in is only about two-thirds of that existing at the sea-level. It was also shown at a much later date, by Ludwig and W. Müller, that animals breathing in a confined space of air will use up the whole of the oxygen in the space; and it is clear that as the oxygen is used up, the partial pressure of the oxygen remaining must be steadily falling. Liebig urged the view that the gases were not simply dissolved in the blood, but existed in a state of loose chemical combination which could be dissolved by the diminished pressure in the vacuum, or by the action of other gases. He also pointed out the necessity of accurately determining the co-efficient of absorption of blood for the gases, that is, the amount absorbed under a pressure of 760 mm. of mercury by one volume of the gas at the temperature of the observation. The next important observations were those of Fernet, published in 1855 and 1857. He expelled the greater part of the gas of the blood (dog) by passing through it a stream of hydrogen and then submitting it to the action of the air-pump. He then introduced into the apparatus the gas under a given pressure, the absorption co-efficient of which he had to determine. He then estimated the amount of gas absorbed, under different pressures, and found in the case of oxygen that the amount absorbed with gradually decreasing increments of pressure was greater than what would have been the case had it been in accordance with Dalton's law of pressures. The oxygen was not then simply dissolved in the blood. Further, Fernet arrived at the conclusion that the greater portion of the oxygen was in a state of combination. By similar experiments made with carbonic acid, Fernet determined that the greater portion of it was in a state of loose chemical combination, whilst a small amount was simply dissolved according to the law of pressures. Experiments with blood serum showed similar results as regards carbonic acid, with the difference that the co-efficient of absorption for oxygen was much less than with ordinary blood. He therefore concluded that nearly the whole of the carbonic acid was chemically retained in the fluid of the blood, whilst nearly the whole of the oxygen was combined with the red blood corpuscles."

Professor Stokes, by reducing arterial to venous blood, and submitting it to spectrum analysis, came to the very important conclusion that "The colouring matter of blood, like indigo, is capable of existing in two states of oxidation, distinguishable by a difference of colour and a fundamental difference in the action on the spectrum. It may be made to pass from the more to the less oxidised state by the action of suitable reducing agents, and recovers its oxygen by absorption from the air."

To the colouring matter of the blood Professor Stokes gave the name of cruorine, and described it in two states of oxidation as scarlet cruorine and purple cruorine. The name hæmoglobin, given to it by Hoppe-Seyler, is generally employed. When united with oxygen it is called oxyhæmoglobin, and when in the reduced state it is termed reduced hæmoglobin, or simply hæmoglobin.

These important researches have given an explanation of the function of red blood corpuscles as regards respiration. The hæmoglobin of the venous blood in the pulmonary artery absorbs oxygen, becoming oxyhæmoglobin. This is carried to the tissues, where the oxygen is given up, the oxyhæmoglobin being reduced. Thus the colouring matter of the red blood corpuscles is constantly engaged in conveying oxygen from the lungs to the tissues. Probably the union of hæmoglobin with oxygen, and its separation from it, are examples of dissociation, that is, of a chemical decomposition or synthesis, effected entirely by physical conditions; but data regarding this important question are still wanting. If the union of oxygen with the colouring matter is an example of oxidation, it must be attended with the evolution of heat.

If we then regard the blood as a respiratory medium, having gases in solution, we have next to consider what is known of the breathing of the tissues themselves. Spallanzani was undoubtedly the first to observe that animals of a comparatively simple type used oxygen and gave up carbonic acid. But he went further, and showed that various tissues and animal fluids, such as the blood, the skin, and portions of other organs, acted in a similar way. These observations were made before the beginning of the present century, but they appear to have attracted little or no attention until the researches of George Liebig on the respiration of muscle, published in 1850. He showed that fresh muscular tissue consumed oxygen and gave up carbonic acid. In 1856, Matteucci made an important advance, by observing that muscular contraction was attended by an increased consumption of oxygen, and an increased elimination of carbonic acid. Since then, Claude Bernard and Paul Bert, more especially the latter, have made numerous observations regarding this matter. Paul Bert found that muscular tissue has the greatest absorptive power. Thus we arrive at the grand conclusion that the living body is an aggregate of living particles, each of which breathes in the respiratory medium passing from the blood.

As the blood, containing oxygen united with the colouring matter (hæmoglobin), passes slowly through the capillaries, fluid matter transudes through the walls of the vessels, and bathes the surrounding tissues. The pressure or tension of the oxygen in this fluid being greater than the tension of the oxygen in the tissues themselves, in consequence of the oxygen becoming at once a part of the living protoplasmic substance, oxygen is set free from the hæmoglobin, and is appropriated by the living tissues, becoming part of their protoplasm. Whilst alive, or at all events whilst actively discharging their functions, as in the contraction of a muscle, or in those changes we term secretion in a cell, the living protoplasm undergoes rapid decomposition, leading to the formation of comparatively simple substances. Amongst these is carbonic acid. As it has been ascertained that the tension of the carbonic acid in the lymph is less than its tension in venous blood, it is difficult at first sight to account for the absorption of carbonic acid by venous blood; but its tension is higher than that of carbonic acid in arterial blood, and it must be remembered that the lymph has had the opportunity, both in the connective tissue and the lymphatic vessels, of modifying its tension by close contact with arterial blood. Strassburg fixes the tension of the carbonic acid in the tissues as equal to 45 mm. of mercury, while that of the venous blood is only 41 mm. We may assume that as the carbonic acid is set free it is absorbed by the blood, uniting loosely with the carbonates and phosphates of that fluid, thus converting it from the arterial into the venous condition. This constitutes respiration of tissue.

Let me ask, can anything be of greater interest to the masseur than information of this kind concerning oxidation and respiration of tissue? The scientific masseur feels that in his every movement, by every exercise of well-regulated pressure, he is assisting to effect and to accomplish life processes of the very highest order.

It is important to notice the enormous absorptive surface for oxygen presented by the red blood corpuscles of man. There are about 5,000,000 red corpuscles in each cubic millimètre. Each corpuscle has a superficial area of 0·000128 square millimètres. Taking the blood in the body of a man of average size at 4·5 litres, that is 4,500,000 cubic millimètres, the number of corpuscles is about 22,500,000,000,000, and this would give a superficial area of 2,880,000,000 square millimètres, or 2,880 square mètres, or about 3,151 square yards—that is to say, the absorptive area of the blood corpuscles is equal to that of a square having each side about 56 yards. The hæmoglobin in a red blood corpuscle amounts to about $\frac{12}{13}$ of its weight. The blood of a man of average size may be taken at 4,536 grammes, or about 10 lbs. Such blood contains about 13·083 per cent. of hæmoglobin, and 4,536 grammes will contain about 593 grammes of hæmoglobin, or about $1\frac{1}{5}$ lb. As regards the iron, which is supposed to be an essential constituent of hæmoglobin, 100 grammes of blood contain

0·0546 gramme. It follows that the total amount, 4,536 grammes, contains about 2·48 grammes, or nearly 39 grains. Twenty-five minims of the tinctura ferri perchloridi contain about one grain of iron, so it will be seen that not many doses are required to introduce into the body an amount of iron as large as exists in the whole of the blood.

The question which naturally arises in my mind in considering the massage movements, in reference to tissue oxidation is this: Do these physical actions dissociate or help to dissociate the oxygen from the oxyhæmoglobin and present the oxygen to the tissues in a form in which they can readily take it up? I should say that such was unquestionably the case. Ernst Fleischl von Marxow believes that this work of dissociation is naturally produced by the stroke of the heart. The blood is kept in motion by a series of quick sudden strokes, because for the taking up of the oxygen by the tissues and the elimination of carbonic acid by the lungs, it is not sufficient that the blood should run steadily through the systemic and pulmonary circulations, and therefore a sharp hard stroke is given to it immediately before entering and immediately after leaving the lungs. All the blood in the body passes through the heart and lungs in twenty seconds; and Pfluger says that in this time one-third of the oxygen is used up by the tissues.

According to the percussion theory, the stroke of the left ventricle arterialises the blood, that is, liberates the oxygen from the hæmoglobin, and this arterialised blood is carried to the tissues. The hæmoglobin does not get sufficient time to recombine with the oxygen, because of the successive strokes of the heart and the vibrating thrill kept up in the arterial ramifications. The free oxygen is used up by the tissues in the capillary circulation to the extent of one-third. After leaving the capillaries, the two-thirds of oxygen again recombine with the hæmoglobin, and in this condition return to the heart, along with one-third of hæmoglobin that has lost its oxygen. In ordinary circumstances, this one-third would again obtain oxygen from the alveoli of the lungs; but if all the oxygen there has been used up, of course it cannot obtain any oxygen. The blood flows from the lungs to the left ventricle, when it is again arterialised, and again sent out through the arteries; but as there is now a large amount of free hæmoglobin present in the capillary circulation, it will seize hold of a part of the oxygen, and the tissues will obtain less than the usual supply. With each successive circulation, the amount of oxygen available for the tissues will become less and less, until the tissues receive none, because all the oxygen set free by each beat of the left ventricle is seized hold of in the capillary circulation by the reduced hæmoglobin. The tissues die from want of oxygen, because there is too much reduced hæmoglobin present, a substance having a greater affinity for oxygen than the tissues possess, a result that would probably occur, as in drowning, in the time of six or eight complete circulations, that is, in three or four minutes.

With these observations concerning the oxidation of tissue, I have drawn largely from the intensely interesting lecture of Prof. McKendrick, which I consider—and many others far more competent than myself to judge of its merits, also consider—is the key note to many grand and important discoveries in the physiology of life, which are at the present time enshrouded in the realms of mystery. And I think it must be evident, that if physiology, anatomy, and pathology are so closely allied that they cannot be separated, we ought not to exclude physics from consideration when we review the life processes of living matter, and the mechanical treatment of degenerated and dying tissue.

Other interesting points relating to the physiology of muscle and nerve will be noticed in those chapters which are devoted to the consideration of these structures in reference to Massage.

Some observations made by Zabludowski on the effects of massage on healthy people, are very interesting and significant. They were made in November, 1881, upon himself, then thirty years of age; upon his servant, twenty years of age; and upon his housekeeper, forty-seven years of age. All three were living under the same conditions with regard to food, activity, and dwelling, and for eight days prior to the massage, examinations were carefully made of their weights, muscular strength, temperature, pulse, respiration, and urine. Observations were made during the ten days in which they had general massage, and also for eight days afterwards. The muscular strength of all three increased during massage. The weight of the one who was tolerably corpulent decreased, as also did that of the slender housekeeper, and, corresponding to this, there was an increased excretion of urates and phosphates. The weight of the one who was but moderately nourished, increased, and with this there was found a diminution of urates and an increase of sulphates in the urine. The massage of the abdomen excited the larger intestine to powerful peristaltic action and caused regular evacuations. Oft-repeated observations showed that there was an elevation of the functions of life in general, and, with the improved frame of mind there were also easier movements of the body. Appetite increased and sleep was soft, gentle, and steady. The effects of the massage disappeared soonest from the moderately nourished person, the servant; and they lasted during the whole time of observation, for eight days after the massage, upon the housekeeper, who, though thin and slender, had lost weight, while upon Zabludowski himself, the moderately corpulent person, the after-effects varied at different times.

Zabludowski has also made some interesting experiments, to learn how fatigued muscles are influenced by massage. Muscles of uninjured frogs were exhausted by a series of rhythmic contractions caused by an induction current. Under massage they soon regained their lost vigour, so that the contractions were almost equal to the first, whilst a rest for the same period, without massage, had no effect. These experiments, showing the restorative effects of massage upon wearied muscles, were more than confirmed in man by the same investigator. He found that after severe exercise a rest of fifteen minutes brought about no essential recovery, whilst after massage, for the same period, the exercise was more than doubled. One person experimented upon, lifted a weight of 1 kilo. (2·2 pounds) 840 times, at intervals of one second, by extreme flexion of the elbow joint, from a table on which the fore-arm rested horizontally, and after this he could do no more. When the arm had been *masséed* for five minutes, he lifted the weight more than 1,100 times in the same manner as before without fatigue. The difference in muscular sensation was very striking after rest alone from work, in comparison with that after massage. In this case, the person experimented upon was an expert subject for experiment, and after he had made 600 lifts of 2 kilos. (probably in the same manner as that just referred to), there was unvarying stiffness during a pause of five minutes for rest; on the contrary, after five minutes' massage the muscles were supple and pliant.

Lastly, Schreiber sums up very practically the physiological effects of massage and mechano-therapy as follows; and for that reason I give you his own words:—

"1. To cause an increased flow of blood to muscles and soft parts, increasing thereby the circulation, and removing accumulations of waste tissue whose retention causes various disturbance of function.

To strengthen muscle fibres, and by setting up molecular vibrations to induce changes, not only on the muscle and nerve fibres, but perhaps even in the nerve centres themselves.

2. To cause the resorption of exudations, transudations, and infiltrations, in such organs as are accessible. To effect the separation of adhesions in tendon sheaths and in joints, without recourse to the knife. To remove by grinding away, intra-arthritic vegetations.

3. To increase by passive and active exercise of all the

muscles, the oxidising powers of the blood, in this way correcting disturbances in its composition and stimulating all the vegetative processes.

4. To relieve the congestion of such internal organs as the brain, lungs, intestines, uterus, kidneys, etc., by increasing the flow of blood to the muscles.

5. To stimulate directly the sympathetic nervous system, thus increasing secretion and reflexly the activity of unstriped muscle fibre, and so relieving various functional derangements.

6. By systematic exercise (health gymnastics) to educate morbidly affected muscles, to convert abnormal into normal actions, and to suppress useless movements.

Lecture II.

THE MODE AND METHOD OF APPLYING MASSAGE.

Schreiber on Massage—Its use by Charcot, Billroth, Benedikt, Eulenberg Esmarch, and others—Definition of the term Massage—Division into Effleurage, Petrissage, Tapotement, and Friction—Instruments for Massage—Nature of Movements—Effleurage Mode of Application—Petrissage Mode of Application—Fothergill on Skill—Tapotement Mode of Application—Rolling and Hacking—The Masseuse—The Human Hand—Instructions to the Masseur in reference to Patients, &c.—Wash for the Skin.

My Lecture to-day is more interesting than my previous one, inasmuch as it is more practical. Let us consider, if you please, the modes of applying massage, and many other matters in detail relative to the massage processes, the masseur, and the patient. I have been reading with great pleasure a very interesting book entitled, "Manual of Treatment by Massage," by Dr. Schreiber, Proprietor and Director of the Sanitarium "Alpenheim" in Aussee, Styria, Austria, translated by Dr. Walter Mendelson, of New York, and I have been much struck with the following passage: "The time was when reputable physicians scrupled to busy themselves with mechanical treatment; or, if they did, hesitated to commit to paper their ideas on the subject, or to contribute, by clinical observations, their mite towards spreading this now no longer new method of cure. That day happily is past, and mechanotherapy may be said to have received its formal scientific consecration at the hands of such men as Billroth, Benedikt, Charcot, Eulenberg, Esmarch, Hervieux, Hüter, Gradeingo, Gussenbauer, Nussbaum, Pagenstecher, Piorry, Trousseau, Winiwarter, and others, and to-day the most eminent physicians do not for a moment hesitate personally to treat disease by manipulations. The mechanical treatment of a patient suffering from sciatica is certainly not more fatiguing than operating for vesico-vaginal fistula, where the operator is often constrained to remain from one to two hours in a most tedious and uncomfortable position. It was formerly customary to assert, with an affectation of superiority, that it would hardly be possible for a regular physician to condescend to use a means until then only in vogue with quacks and female 'rubbers.' But as quacks prescribe all sorts of medicines too, this objection can scarcely be considered a valid one. Surely, the writing of a prescription, which is but too apt to reveal small diagnostic acumen, and even less knowledge of drugs, does not require more intelligence than the mechanical treatment of sciatica, which cannot be undertaken without a knowledge of both anatomy and physiology. Prescription-writing often gets to be a matter of routine, requiring in time but little exercise of the intellect. The mechanical treatment of writer's cramp, chorea, or neuralgia, on the other hand, presents numerous and interesting modifications, all of which have carefully to be considered, and which constantly present new incentives to the inventive powers."

I must say that I am quite in agreement with these remarks of Dr. Schreiber. I define the term massage to mean, "The application of sentient living matter to sentient living matter in multifarious ways." The terms such as Effleurage, Petrissage, Tapotement, and Friction (I do not know who invented these terms), are very useful as a basis or foundation for certain well-defined manipulations, and I shall therefore use them in describing the modes of applying massage; and I must repeat that massage, in my practice, is conducted by the hand, and by the hand only. I now show you these three instruments which have been invented to supersede the human hand, and nothing could be more ridiculous or contemptible: First, we have this thing which is called Klemm's muscle beater; secondly, this represents, as you see, an auctioneer's hammer; and third, this instrument is supposed to adapt itself to roll the muscles. These instruments can be obtained of any of the instrument makers, but do not use them, I beg of you. If massage is to be performed in this rough, coarse way, then there is an end of the whole business so far as I am concerned.

Let me impress upon you one of many very important points which experience has taught me: namely, to manipulate quietly, calmly, gently, and purposively. Never allow your movements to be performed in a hurried, indifferent kind of way. I am quite sure that the best effects are brought about by almost painless manipulations, and the most troublesome consequences not infrequently result from rough, jumping, jerky, unmethodical work. You will see directly how my manipulations are performed, and I shall again refer to this matter.

EFFLEURAGE.—This term is applied to all stroking forms of movement, light movements, free from pressure, whenever surface is brought into contact with surface. If pressure be exercised, we then travel over the border line of effleurage and enter that of petrissage; but effleurage and petrissage movements frequently run one into the other, according as they are performed with more or less pressure. These stroking movements may be carried on with the tip of one finger, or with the tips of all the fingers in the following manner: With the tips of the thumbs, so (*Fig.* 19, p. 66); with the backs of the hands, or sides of the hands, or with the palms of the hands (*Fig.* 17, p. 64); also with light rolling to and fro, friction movements (*Fig.* 9); and in working lightly over the fore part of the leg (*Fig.* 31); light, very slightly percussive movements with the tips of the fingers running over a part as in playing a piano, and titillating the part. All such are decidedly effleurage movements, and I advise you in operating upon any part of the body to commence with these in order to excite the superficial reflexes. We consider that effleurage manipulations are particularly applicable to the head, neck, and upper extremities. The physiological effects of effleurage are indirect, and for the most part reflex.

Effleurage movements, then, if you please, are of the most superficial, light, frictional character. You will often find it necessary in commencing or prior to massaging a part, to raise the temperature by some means; therefore, if it is necessary, you must effleurage with considerable quickness and velocity, so increasing the heat of the surface by friction, and stimulating the cutaneous circulation, and the peripheral nerves. Again, I frequently run over a part, say the fore arm, with my finger and thumb, so; it does not amount to pinching, yet it is very near it, but the effect upon the patient is pleasant and stimulating.

PETRISSAGE—Is a very useful word. It means pinching, kneading, and working into the deep structures, by bringing or rather massing them together. I used at one time to think of this as by far the most important of all the manipulations, yet every manipulation has its special work and special value. I bring my finger and thumb together, so; please to follow my movements, roll your own fingers and thumbs in the manner I show you. Now do it lightly, and now exercise pressure. Take a piece of your own skin and pinch it, just so; you now experience what the effect of such operation would be upon your patient. Remember what I told you in my first lecture, do not pinch too hard or you will destroy the vitality of the part which you are manipulating. Although the great object of massage is to bring all parts together by direct pressure, still the pressure must be diffusively, not absolutely direct, in other words, the petrissage movement should be rolling in its nature, slow, and purposive in its action. It is usual, and the practice is a good one, to work from the extremity towards the centre of the circulation, in the course of the venous blood and lymph flow; but in the chest and back we take the course of the muscles and the ribs. For instance, in massaging this chest, you see I work from the sternum, from the origin of the great pectoral muscle towards its insertion; when I come to demonstrate upon the back and spine, you will see that my movements are in the direction of the spinalis and longissimus dorsi muscles; but in the extremities you will observe that the movements are from insertion to the origin of the muscle. No little fuss has been made by some authors upon the value of what is called working up-stairs. I am not quite sure what this means, but if one is to understand by it that one hand is to precede the other, as one foot precedes the other in going up-stairs, then I am quite sure that my own mode of operating is far superior. I now show you what I mean: you can operate on yourselves, judge for yourselves, and note the effects and the perfection of petrissage movements. Take an extremity for instance. You see you can throw the entire hand into the parts upon which you are operating, so that for the moment they are welded together. Do not work with your thumbs transversely, place them vertically upon the limb after this manner (*Fig.* 7), and throw the wrist as well as the ball of the thumb into the work. Always remember to work fingers and thumbs, "thumb hand" and wrist hand, thoroughly and completely, all together, before abandoning the clutch. Never remove your hand entirely, but work on with your hands in contact with the limbs just as I now show you; by so doing the pressure is equalized—and allow me to tell you this is of great important in petrissage movements. Let me show you how some masseurs petrissage. Their hands jump about in this manner, sometimes up, sometimes down; in fact, they are all over the body before you can say Jack Robinson, and they think they have done marvellously well because they are breathless, and either as red as a lobster, or pale as death.

But I have referred to this sort of thing before, and I attach so much importance to it that I shall possibly speak of it again and again. Some masseurs draw attention to a squeezing form of petrissage, but after all it is nothing more than pinching. If I take the muscles of the ball of this thumb thus, between my own thumb and fingers (*Fig.* 4), squeezing and rolling them about in this way, I certainly exercise the parts in a very notable and healthful manner; but squeezing and pinching are more or less synonymous terms, and it is just as well to introduce as few terms as possible, for a multiplicity of them is quite unnecessary. In all petrissage movements, no matter whether they are performed by the finger and thumb, or by the fingers and thumb, or by the entire hand, one part is usually a fixed point; for instance, in working rapidly in this way, you see my thumb is the fixed point, and I draw my fingers to my thumb; on the other hand, you see my fingers are fixed points, and I draw my thumb towards them. In working with the entire hand, thus, you see the wrist part of my hand is the fixed point, towards which the palm of my hand and the phalanges exert their pressure. Now, please observe my manipulations and you will see exactly what I mean. It will take you some time to perform manipulations, even of the most simple kind, with dexterity. You must take every possible opportunity to practise every kind of movement. It is not so easy to acquire skill as you might suppose. There are some people born with capacity to effect certain things by mere intuition; but genius is not common to all, therefore you must again let me remind you that you can gain by acquirement, by determination, and devotion to your work, that skill which leads to accomplishment and perfection. Persevere then, and you will succeed. Let me also tell you another thing: when you are once perfect in massage manipulations, you will have to be constantly practising if you wish to remain so. It is the same with all handicraft workers. The skilled surgeon, pianist, oarsman, billiard player, and so on, will all tell you how essential practice is to them if they wish to keep in the front rank.

The late Dr. Fothergill's words in reference to this matter are of the highest possible value. He says, "The knowledge which one man acquires by the sweat of his brow after years of patient toil and painstaking cannot be transferred in its entirety to another. Individual acquired skill cannot be passed from brain to brain any more than the juggler, who can keep six balls in the air, can endow an onlooker with like capacity by merely showing him how it is done. The muscles, and still more their representatives in the motor area of the brain hemisphere, require a long training before this manual skill can be acquired." I must also remark here that it is next to impossible to explain to you every form of massage manipulation. You must in a measure think for yourselves; you must bring your judgment and your reason to bear upon every movement, and you will find how necessary it is for you to gauge your patient's resisting power. But these are points to which I shall again refer. I advise you most seriously to practise upon each other, and do not treat this piece of counsel as a mere joke, for it is of the greatest importance. You can never do what is necessary unto others unless you know by experience what others are capable of doing unto you. I will now draw your attention to

TAPOTEMENT.—All the movements included under this term are tapping, vibratory, percussive, succussive, and concussive in their nature. The proximate effect produced by tapotement is very different to that produced by petrissage, and these movements are specially applicable to certain parts of the body to bring about definite results where the petrissage movements would be of little or no avail. I shall show you that petrissage is particularly useful in massing muscle together in the legs, thighs, and buttocks. On the other hand, tapotement movements are applied particularly to the back, chest, and abdomen and the trunk of the body. It is sheer nonsense to say you can squeeze the liver, and empty it of its contents in the same way that you would squeeze a sponge. I will defy any one to do anything of the sort. You can, as I shall show you in a future lecture, stimulate this organ into activity by percussion and succussion.

Then, please understand, the mechanical effect of tapoting is chiefly to bring about vibration. Of course this is all a question of degree ; Dr. Granville's perceutor is merely a mode of tapotement, so is the dentist's apparatus when the instrument he is using to stop your tooth is worked by the electro-motor, and so is the current from this Faradic battery, it certainly stimulates the parts into states of kinetic or active energy, more than any other form of massage with which we are acquainted.

The simplest form of tapotement is tapping, which I exemplify to you in this way, by playing with my fingers over this patient's forehead. Now, let me show you one form of hand for tapotement. Close your hands partially, so, by bringing your two first fingers to rest upon the ball of your thumb. Do not make a fist of your hand. You will observe that your hand now forms a cavity. Apply it to the flat palm of your other hand, and note the effect in sound and feeling. Now, make a fist of your hand and apply it to the other hand as before, and note carefully the difference. Again. Make a saucer of your hand by bringing your fingers close together, and causing your hand and your fingers together to become concave. These are the two common forms of hand for tapotement.

But the most active is the flagellating hand. Observe my hand, if you please, see how it drops and swings from the wrist : work it rapidly in the way I show you. Now, note the effect upon this back ; remember I have merely brought the tips of my fingers into contact with the surface ; just see how it has stimulated the circulation. Now, if you please, use the dorsal aspect of your fingers in this manner ; let them fall upon your patient. Now, try the hacking hand, and tapote rapidly, so, with the ulnar side, that is, by the medium of your little and ring fingers. (*Fig.* 10, 30.) These, then, are different modes of bringing about percussion, and they are all included under the head of tapotement.

I advise you, when operating in this way, to keep your arms close to your side and work almost entirely with the forearms. By this means you can graduate your movements with greater nicety and delicacy. Your movements must be rapid. Do not raise the hands more than half an inch from the surface of the body, and see you travel over every bit of ground carefully. With practice you will find that you can graduate your movements so that they are scarcely perceptible to the patient; on the contrary, you can, of course, use much more force than your patient can bear. I shall speak to you again of these and other forms of massage, when I call your attention to local massage in subsequent lectures.

Now, my patient, Mrs. G., will thoroughly bare her right arm, and I will demonstrate to you by successive stages the various modes of applying massage to it. You will see that my first object is to ascertain the exact condition of the limb; whether there is anything abnormal about it, either with regard to the nails or the joints; whether its general development is good or indifferent; whether the skin is harsh or soft, dry or moist; whether it sets firmly upon the muscles; or whether it is relaxed and easily drawn out. I then, you see, examine the muscles somewhat carefully and mark their outline, their firmness or their flabbiness, their power of contraction against resistance, the grip of the hand, the temperature of the hands and fingers, and the moisture or dryness of the hand and the conformation of the nails. All these are points of practical value which will come before us again. I will ask Miss S. to make careful notes of this examination, so that after the patient has undergone a course of treatment, the two conditions can be compared together. I now take the limb and make a few friction movements over its general surface, so, and commence my manipulations after this fashion: I grip the hand and the phalanges firmly with my own left hand (*Fig.* 1), and with my right hand I extend and flex every phalangeal joint.

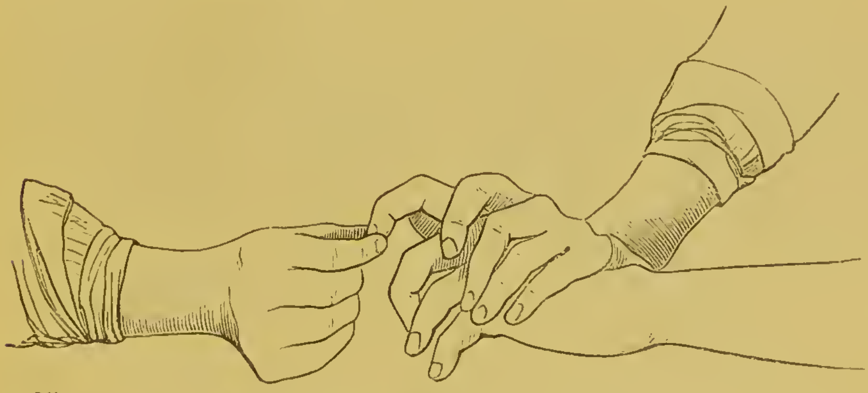

Fig. 1 illustrates the first position for manipulating the finger joints of the upper extremity.

Having done this, I flex and extend thoroughly, some half dozen or even more times, the metacarpo-phalangeal joints (*Fig.* 2.)

After this the intrinsic phalangeal muscles are rolled and pinched between the finger and thumb. Observe, if you please, that my finger and thumb roll the tissues. This means that the tissues move in unison with the pressure applied. I then work well in between the metacarpal bones.

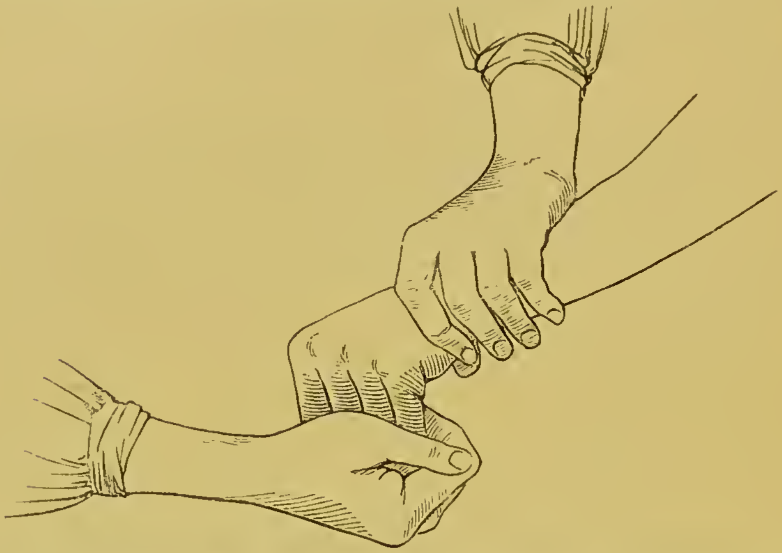

Fig. 2 illustrates passive gymnastics of the metacarpo-phalangeal joints.

I next deposit the dorsal surface of my patient's hand in the palm of my left hand, and place the palm of my right hand upon that of my patient, and exercise both by percussion and friction several brisk movements. (*Fig.* 3.)

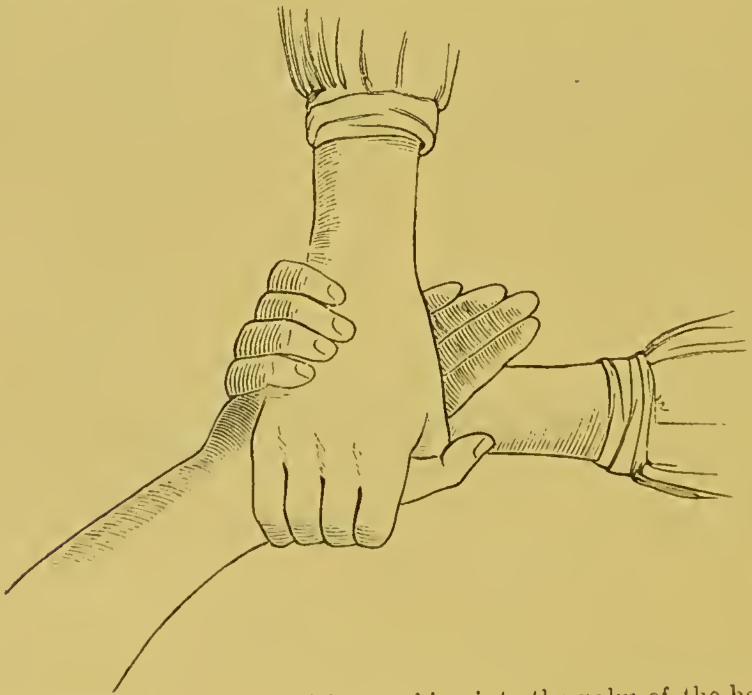

Fig. 3 illustrates the method for working into the palm of the hand.

Now I petrissage deeply into the muscles of the palm, pinching particularly the muscles of the ball of the thumb (*Fig.* 4.) and with a few general and rolling movements the operations upon the hand are completed.

I now direct my attention to the wrist joint. By flexion and extension as well as lateral movements, I ensure the perfect freedom of this joint. (*Fig.* 5.). Let me tell you that I work up the limb by stages from joint to joint, that is, from the wrist to the elbow and from the elbow to the shoulder. I may say that thorough manipulation of the joints, whether they require it or not, is one of the essential features of my system; for I hold that so long as a joint remains badly nourished, so long will it be impossible for the nutrition of the limb to be improved.

But this is a matter which I shall bring more thoroughly before you when we have joints especially under our consideration. If you will observe my manipulations, you will now see that I petrissage deeply all the ligaments and tendons and other structures in connection and in association with the wrist joint. (*Fig.* 6.)

I now commence to operate upon the forearm from the wrist to the elbow, by making several effleurage and friction movements with the palms of my hands, and titillating movements upon the skin with my fingers and thumbs, producing increased vitality of the surface. I now come to proper petrissage movements, which are of two kinds: superficial and deep. These movements must be of a centripetal character, in the direction of the flow of the lymph and venous blood.

The superficial petrissage movements are best performed by the first and second fingers, with the thumb and with the ball of the thumb.

In these manipulations, which act upon the skin and the underlying fat and cellular tissue, the parts are not only pressed upon and rolled, but they are at the same time strained and stretched laterally. You will now see how my deep petrissage movements are performed, and you will readily understand, if you watch my hands, how they mould themselves to the tissues upon which I am operating. Observe, I flex my patient's forearm slightly so as to relax the muscles, and by this means I am able to mass them together.

I wish to draw your attention here to a point of some importance relative to this procedure. You see I not only work with my hands and fingers at the same time, but I throw the carpo-metacarpal parts of my hands and the balls of my thumbs well into the tissues, in order that I may effect greater and more uniform pressure. (*Fig.* 7.)

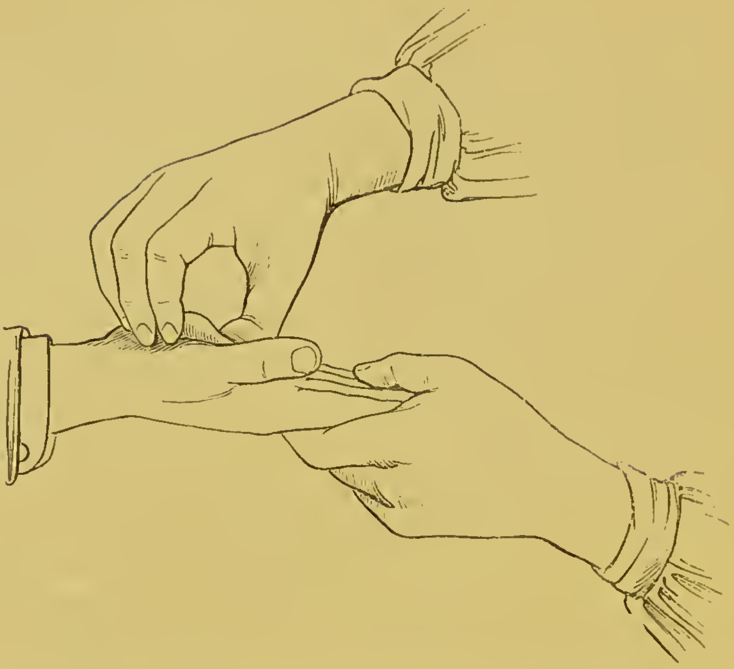

Fig. 4 shows a common mode of petrissaging the muscles of the ball of the thumb.

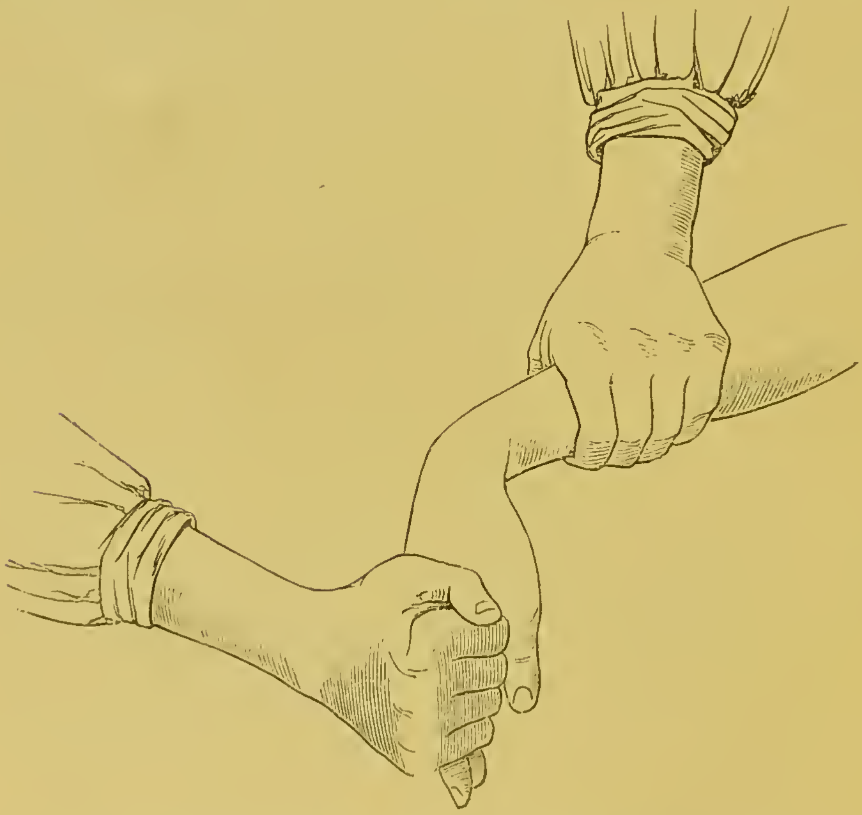

Fig 5. Passive gymnastics of wrist joints. The arm is held firmly whilst the wrist is flexed and extended some twenty or more times.

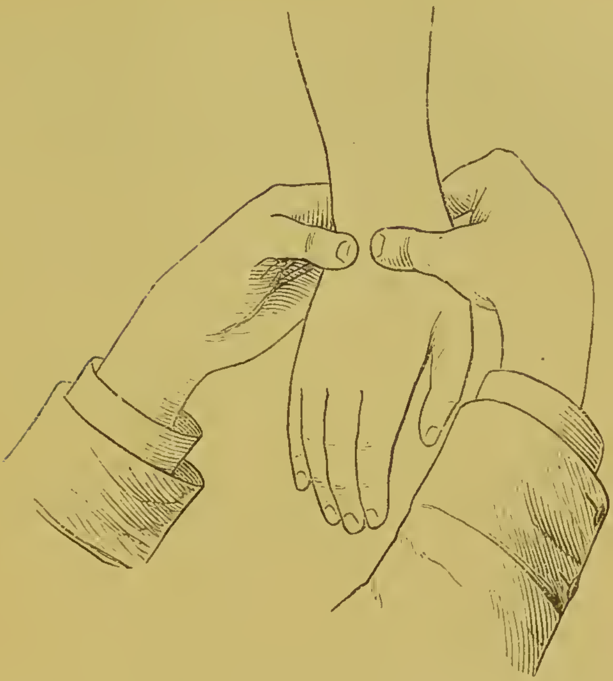

Fig. 6 shows the way the wrist joint is massaged, fingers and thumbs working simultaneously.

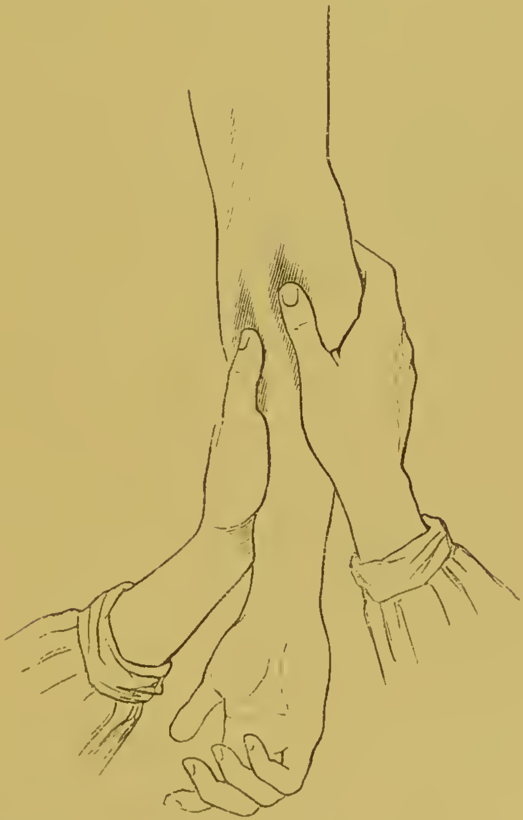

Fig. 7 indicates fairly well deep petrissage of the forearm. The thumbs are placed upon the limb vertically, so as to throw the heel of the operator's hand into the process

I now roll the forearm between my hands, and use slight tapotement and flagellation. The next step you see is to perform passive extension and flexion of the elbow joint. I grasp the back of the arm firmly with my left hand, fixing, in fact, this arm, and so moving the forearm upon the arm. (*Fig.* 8.)

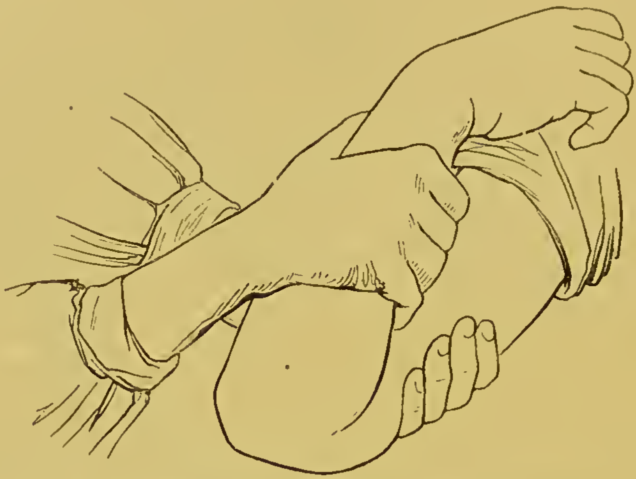

Fig. 8. Passive gymnastics of the elbow joint.

After flexion and extension have been performed some six times, I make myself sure that the radio-ulnar joint is free, by taking the hand of my patient and fixing at the same time my thumb upon this joint. I then pronate and supinate the forearm. Then my next procedure is to work well into the elbow joint in this manner, having, as you see, the joint flexed. The movements now to be made upon the arm are precisely simular to those which I have just gone through upon the forearm; and I finally, if necessary, use rolling and ulnar tapotement. (*Figs.* 9, 10.)

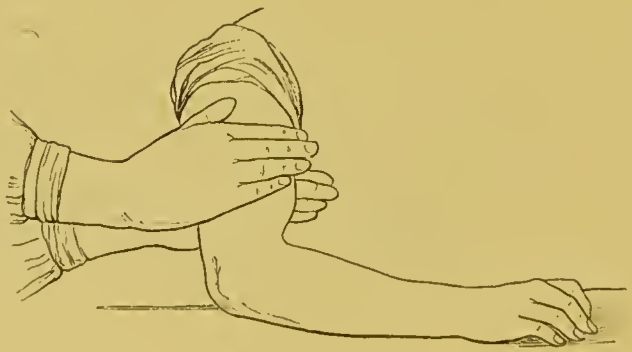

Fig. 9. Light friction rolling; effleurage movements of skin; deep petrissage movements can be effected by exerting increased pressure.

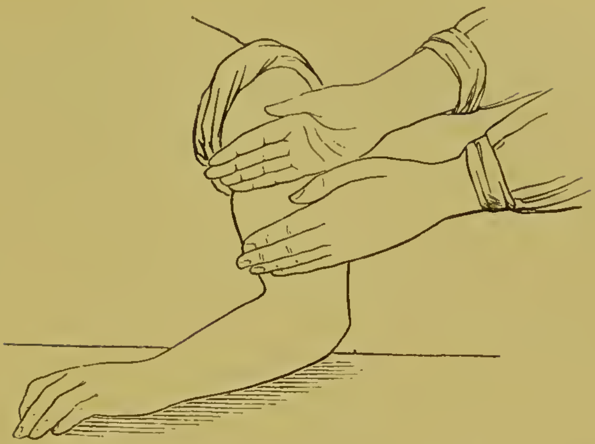

Fig. 10 shows position of the hands for light ulnar tapotement. This form of tapotement is usually applied to the abdominal muscles.

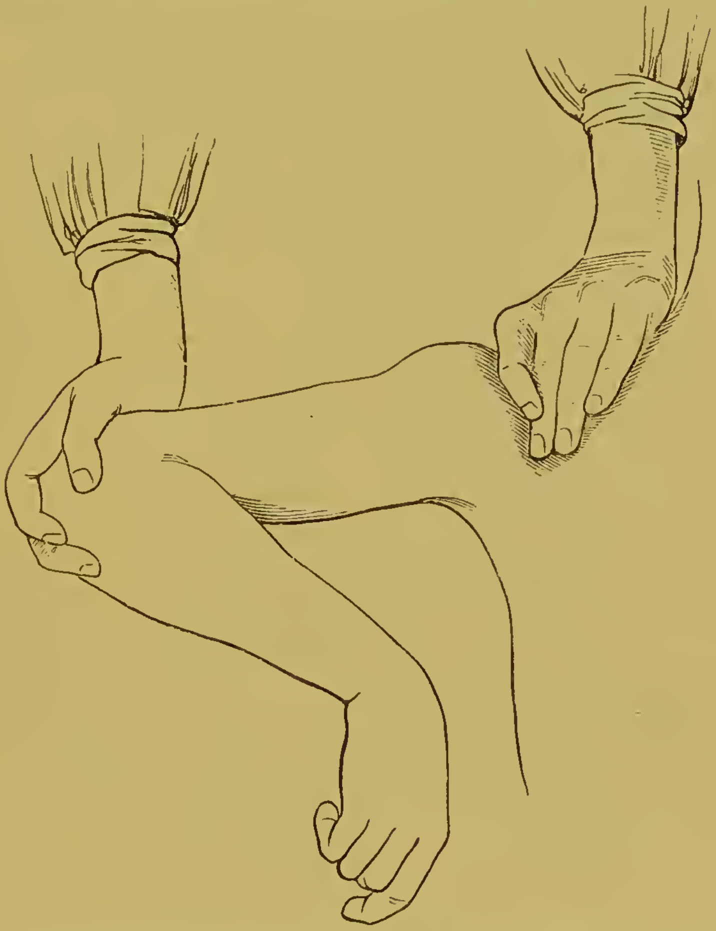

Fig. 11 shows position for manipulating the shoulder joint; the operator fixing firmly the clavicle and scapula with one hand, whilst the movements of the joint are effected by the other hand.

The last joint to which I have to call your attention, as far as the upper extremity is concerned, is the shoulder joint.

We shall find that adhesions of a rheumatic character are here exceedingly common.

In order to bring about the different movements of this joint, it is customary for the operator to place himself behind the patient and fix the scapula by pressing firmly upon it and the clavicle. (*Fig.* 11.)

You must not fail to observe how necessary it is to fix the scapula, if you wish to make yourself quite sure of the limitation of movement in the shoulder joint.

I will now, if you please, direct your attention to the lower limb, but do not commence to massage any other part than the arm until you have made yourself quite familiar with the different modes of manipulation. If your patient is not in bed, you can be seated in a chair, in this manner, with the leg of your patient resting upon your thigh; (*Fig.* 12.) but you will have to be constantly varying your position according to the part of the leg and foot upon which you are operating.

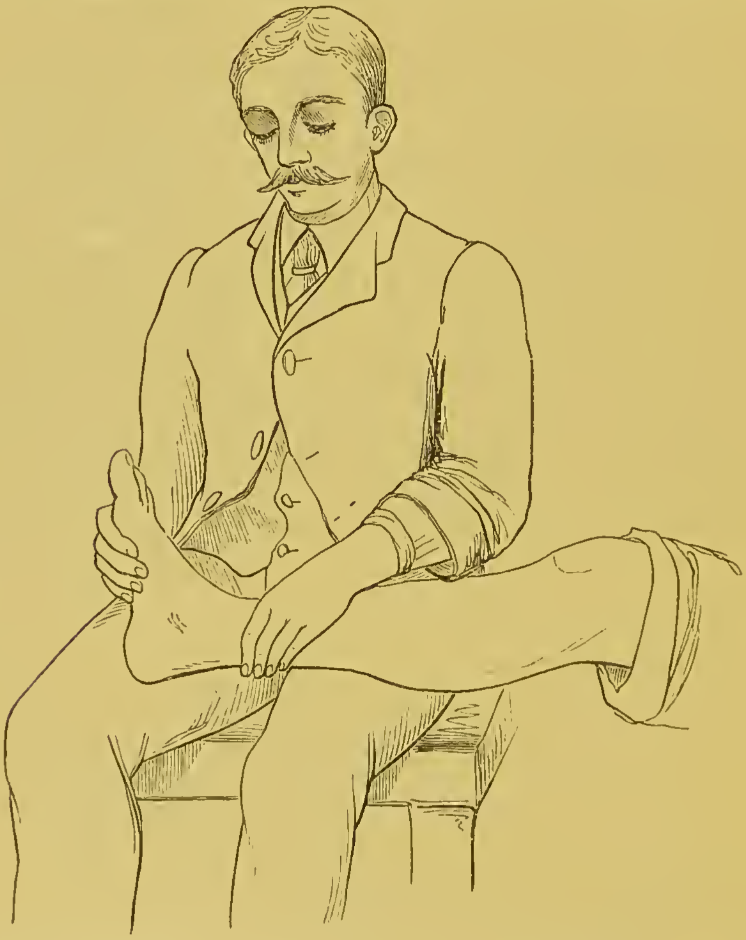

Fig. 12 shows merely the common way of commencing work upon the ankle joint for flexion and extension.

The movements required for the leg are essentially of the same character as those for the arm ; every toe and every toe joint must be flexed and extended after the manner adopted for the fingers. Then the muscular and bone interspaces are petrissaged. (*Fig.* 13.)

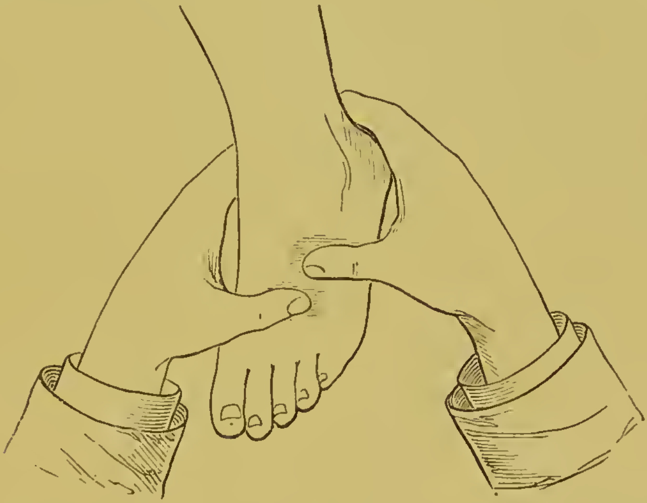

Fig. 13 indicates position for petrissaging the foot and working at the same time with the fingers into the malleoli.

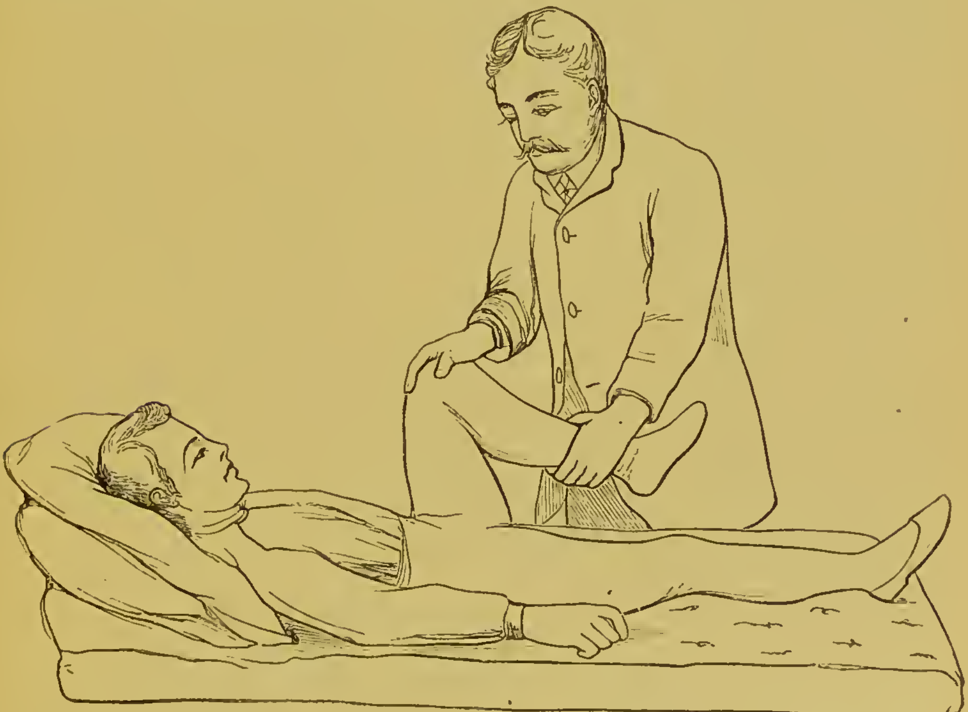

Fig. 14 shows position for ordinary knee and hip movements (passive gymnastics.)

If you follow my movements you will see how admirably the balls of the thumbs are adapted for working around the malleoli of the ankle joint, and these movements must be followed by pressing and friction movements into and upon the plantar structures of the foot. The tendo Achillis must receive more than an ordinary share of attention, and the ankle joint be flexed and extended, and the foot inverted and everted. After this you see, I work at the leg in precisely the same way that I operated upon the forearm. Another excellent way to work into the muscles of the calf is to flex the leg after this fashion with the patient lying down. You can see now how thoroughly I get hold of every bit of muscular tissue, working of course from the heel upwards to the popliteal space.

The knee is now thoroughly flexed and extended after the manner I here show you (*Fig.* 14.), and the thigh massaged by deep petrissage movements. The fat and muscles of the thigh frequently form a thick fleshy mass, so that tapotement in addition to petrissage movements is required.

You will observe exactly how I hold this leg to put the gluteal muscles and the sciatic nerve upon the stretch in severe cases of sciatica (*Fig.* 15). The thigh is forced over the abdomen to the opposite side of the body, and kept in this strained posture for one or two mintues. It is then extended and slightly abducted also with some force. When I lecture to you upon joints I shall refer to all these matters in detail.

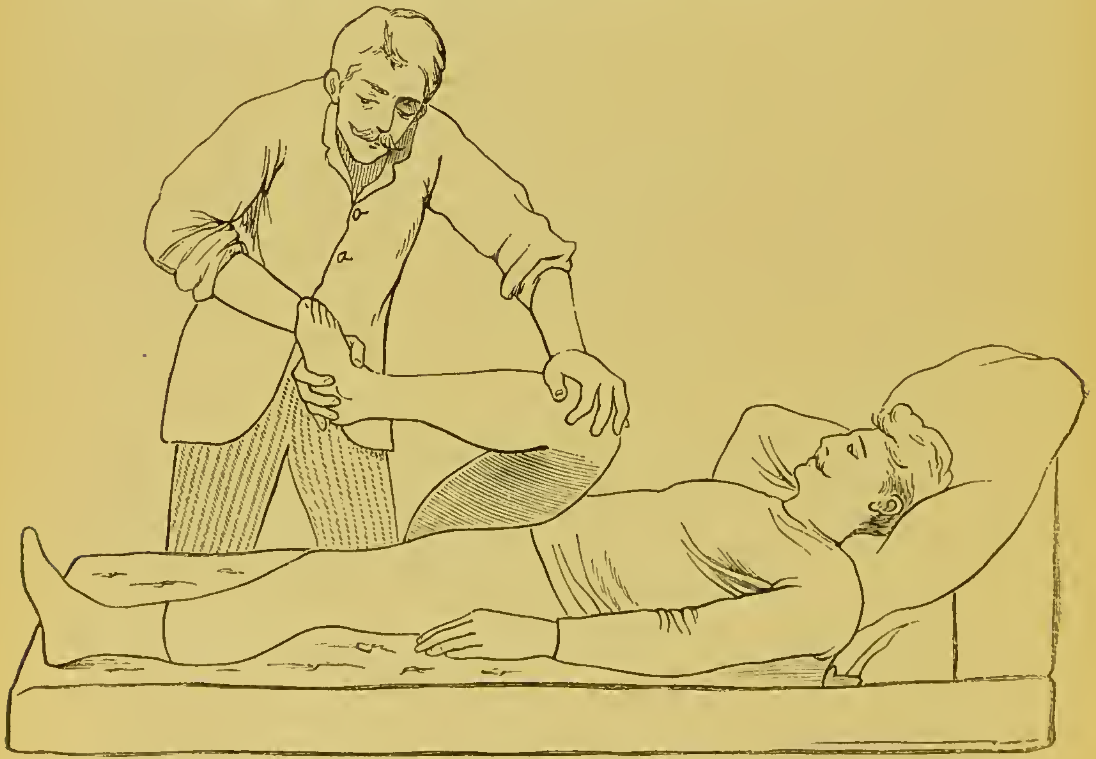

Fig. 15 shows position of extending and stretching sciatic nerve by flexing the thigh well upon and over the abdomen.

I must now call your attention to some points of interest and importance relative to the masseuse, time of operating, length of operation, &c. With reference to the individuality of the masseur and the masseuse, I must say that some individuals are utterly unfitted for the office by nature, by education, by general development and by disposition. I have no wish, in fact I will not try to lay down a hard and fast line concerning physical development to the entire exclusion of a large number of persons who fail to come up to the exact standard, for it must be remembered that our patients to be massaged are not all of the same type, either mentally, morally or physically. Young children for instance do not require the same standard of masseuse that would be required for a fully developed adult.

The standard of individuality for the masseur or masseuse may be thus defined:

1.—Good physique and good health absolutely essential.

2.—Cleanliness in every particular is of the greatest importance.

3.—An intelligent interest in the patient's welfare.

4.—Perfect devotion and zeal in carrying out fully and carefully the duties of the work to the minutest detail, so as to ensure the confidence of the patient.

5.—Good temper and forbearance are necessary.

6.—Absence of fuss and undue haste.

7.—Intelligence and even refinement are advantageous.

8.—A happy cheerful disposition with vivacity and dexterity, readiness and ability, not forgetting a pleasant contented face, complete the standard of individuality.

Let me now draw your attention to the human hand. You cannot massage unless you are clever with your hands. Of course, massage is made up of manipulations, therefore you certainly should know something about the hand. I assure you, if you do not already know it, that the hand is a study of the highest physiological, anatomical and pathological significance. I was much interested in reading *The Bridgewater Treatises*, "On the Power, Wisdom and Goodness of God as Manifested in the Creation," vol. 10. "The Hand; Its Mechanism and Vital Endowments as Evincing Design," by Sir Charles Bell. This learned and gifted surgeon says: "The human hand is so beautifully formed, it has so fine a sensibility, that sensibility governs its motions so constantly, every effort of the will is answered so instantly, as if the hand itself were the seat of that will; its actions are so powerful, so free, and yet so delicate, that it seems to possess a quality instinct in itself, and there is no thought of its complexity as an instrument, or of the relations which make it subservient to the mind; we use it, as we draw our breath, unconsciously, and have lost all recollection of the feeble and ill directed efforts of its first exercise, by which it has been perfected. We ought to define the hand as belonging exclusively to man, corresponding in sensibility and motion, with that ingenuity which converts the being who is the weakest in natural defence to the ruler over animate and inanimate nature."

You will remember how frequently I endeavour to impress upon you the value of the thumb in manipulations.

Sir C. Bell, in speaking of the thumb, says, "On the length, strength, free lateral motion and perfect mobility of the thumb, depends the power of the human hand." The thumb is called *pollex* because of its strength; and that strength is necessary to the power of the hand, being equal to that of all the fingers. Without the fleshy ball of the thumb the power of the fingers would avail nothing; and accordingly, the large ball formed by the muscles of the thumb, is the distinguishing characteristic of the human hand, and especially of that of an expert workman.* The loss of the thumb almost amounts to the loss of the hand, and were it to happen in both hands it would reduce a man to a miserable dependence; or, as Adoni-bezek said of the threescore and ten kings, the thumbs of whose hands and of whose feet he had cut off, "They gather their meat under my table." The motions of the fingers do not result merely from the action of the large muscles which lie on the forearm, these are for the more powerful efforts; but on the palm of the hand, and between the metacarpal bones, there are small muscles (lumbricales and interossei), which perform the finer motions—expanding the fingers, and moving them in every direction with quickness and delicacy. The combined strength of all the muscles in grasping must be very great. Indeed, the power is exhibited when we see the sailor hanging by a rope and raising his whole body with one arm. What then must be the pressure upon the hand. The elastic pad in the foot of the horse and camel is not a whit more appropriate than the fine elastic texture of the hand! To add to this purely passive defence there is a muscle which runs across the palm, and more especially supports the cushion on the inner or ulnar edge. It acts powerfully as we grasp; and it is this muscle which, raising the edge of the palm, hollows it and adapts it to hold water, forming the cup of Diogenes.

Whilst the cushions on the ends of the fingers defend them in the powerful actions of the hand, they are also useful in subservience to the nerves of touch, conferring a power of receiving impressions which the utmost delicacy of the nerves themselves could not bestow. We must not omit to speak of the hand as an instrument of expression. Formal dissertations have been written on this; but were we constrained to seek authorities, we might take the great painters in evidence, since by the position of the hands, in conformity with the figure, they have expressed every sentiment. Who, for example, can deny the eloquence of the hands in the Magdalens of Guido; their expression in the cartoons of Raphael; or in the Last Supper, by Leonardo da Vinci? We see there all that Quintillian says the hand is capable of expressing. "For other parts of the body", says he, "assist the speaker; but these, I may say, speak themselves. By them we ask, we promise, we invoke, we dismiss, we threaten, we intreat, we deprecate, we express fear, joy, grief, our doubts, our assent, our penitence, we show moderation, profession, we mark number and time." The natural position of the hand is certainly indicative, in a measure, of the character of the individual. For instance, the hand of the Venus de Medici is what may be termed the nervous, sensitive hand; there is the slightly drooping wrist, the extension of the metacarpo-phalangeal joints, slight bending of the fingers with the thumb drawn backwards; whilst in the Diana of the British Museum, which is the typification of a strong woman, the hand is free, the wrist extended, and the fingers and thumb flexed. This condition of hand is usually considered to be indicative of will, determination, energy, and power; and it is well known that persons in whom the thumb is largely developed have energy, will, and individuality.

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* Albinus characterizes the thumb as the lesser hand, the assistant of the greater—*manus parva. majori adjutrix.*

These are passing points of interest and are worth remembering.

The perfect hand for massage work should be soft, smooth, dry, and fleshy, and of good normal, healthy temperature.

The square hand, with powerful thumb adductors, is usually found most useful; but the following conditions in the nature of the hand are of unquestionable value, namely: good muscular power, suppleness, pliability, flexibility, firmness of grip, and compliancy to yield readily, impressibility, smoothness, fineness, warmth, even delicacy. A damp, cold, clammy hand is totally unfit for massage manipulations.

You will find that every part of the hand must be made available, and there is no position which the hands and fingers can assume which cannot be adapted to some form of massage.

Whilst considering the masseur, I am anxious to draw your attention to several points of importance. The first is, that you keep yourselves in good health, take three good meals a day, but never take stimulants until your work is over; then, provided you are in active work, you will find a bottle of stout and a good night's rest restore your energy, and equip you for the following day's work. Avoid working on Sundays, if you possibly can ; and on this day get fresh air and natural exercise. Now, please to clearly understand me upon this point. If you are in active work, you will have to conserve your energy in every way possible. You cannot, for instance, walk a mile, even to your patient ; for should you get to your work flushed, hot, and wearied, you are doing yourself and your patient an injustice..

And now we will consider our patient from several points of view. The room should be of comfortable temperature, say from 62° to 65° F. The couch or bed upon which the patient is placed should not be too soft or yielding. As little as possible of the body of the patient should be exposed at one time. In general massage one hour should lapse after a meal before the process is commenced, and the process should extend from thirty to forty minutes, twice a day, between 11 and 12 in the morning, and 5 and 6 in the evening ; or between 12 and 1 mid-day, and 8 and 9 at night,

During the *séance*, I strongly advise you not to talk to your patient or allow your patient to talk to you. This, which is a very common practice, mars the good effects of the operation. No operator can manipulate well and thoroughly, and be trying at the same time to amuse his patient, of this I am quite certain. Not only does the masseur or masseuse become exhausted, but the patient, instead of feeling refreshed by the manipulations, becomes exhausted also. I know it is a difficult matter to decline answering the ridiculous questions which patients will sometimes put to you : relative to how long you have been at the work, whether you have any very interesting cases on hand, how many patients you have cured, and so on. All you have to do, is to tell your patient to be quiet until the operation is over, or until you have finished the part upon which you are working. I have heard that the success of some operators depends more upon the way they use their conversational powers than the way they manipulate. I do not believe that success of this kind can be lasting. Then, if you please, always enjoin silence during the time that you are manipulating. *Do not talk to your patient, and do not allow your patient to talk to you.*

After the operation is over, it is imperative that the patient should be made thoroughly warm, and be kept at rest for half an hour. I want you particularly to remember this question of warmth after every form of massage, whether local or general. "Always endeavour to maintain the heat which your energy has generated and created." When it is necessary for you to perform petrissage, and pinch and knead the deeper muscles, where you want to exercise energy and pressure, the skin can be advantageously washed with a spirit and ammonia lotion. What I commonly use has the following composition, namely:

Liq. Ammon. fort. ℥ss. | Aquæ Aurant. flor. ℥j.
Spirit Vini Rect. ad ℥viij.

Vaseline and other tar compounds are highly objectionable, and so are preparations bearing the name of electron.

Lecture III.

MASSAGE OF THE HEAD AND NECK, AND THE PARTS IN ASSOCIATION THEREWITH.

This Lecture treats of the Fifth and other Cranial Nerves—The Sympathetic Ganglia of the Neck—Headache—Megrim—Tic Douloureux—Goitre—Throat Deafness—Menière's Disease—Singing noises in the Head and Ears, &c.

Before I attempt to demonstrate to you the manipulations which are common to the head and neck, I must call your attention, as I have done before, to the fifth nerve and its connection with the cervical ganglia of the sympathetic. I do not expect you to remember the anatomy of the nerve in detail, but perhaps you will follow me attentively whilst I point out to you the ganglionic connections and a few other points of importance. Let me tell you at once that massage of the head and neck is one of the most, if not the most, valuable therapeutic agent which we have at our command for the curative treatment of headaches, inveterate neuralgias, giddiness, singing noises in the ears, Menière's disease, throat deafness and goitre, and I would have you observe that the continuous galvanic current is unquestionably of great value when used with it or in addition to it. I shall bring forward several cases in proof of my assertion, and you can also see many cases which are now under treatment.

The fifth nerve gives sensation to the entire skin of the head and face (except in the occipital region and the back and lower part of the ear, which are supplied by branches of the cervical plexus and great occipital nerve) and the mucous membrane of the mouth, with the exception of the posterior pillars of the fauces and the posterior third of the tongue, which derive their sensation by means of the glosso-pharyngeal nerves.

In this diagrammatic representation which I now show you is seen the outlines of the various regions represented as supplied by the different sensory nerves on the head (*Fig.* 16).

When you have made yourselves acquainted with these nerves and their anatomical distribution you can then use these sensory areas as guides to diagnosis, showing which branch of the nerve is particularly involved, say, for instance, in diseases like brow ague, auriculo-temporal neuralgia, infra-orbital neuralgia, toothache, and so on. You must clearly understand that it is to these different sensory areas that you will have to direct your attention in performing the different massage movements of the head, and it is well that you should know when manipulating what special branches of the fifth nerve you are operating upon.

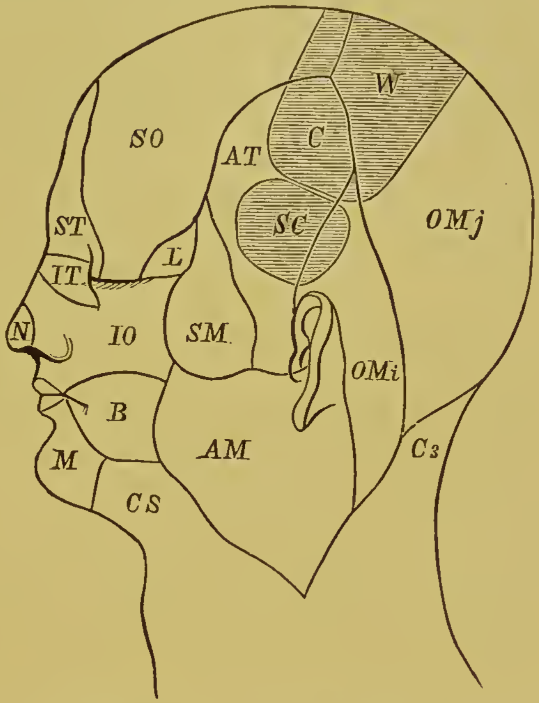

Fig. 16. Distribution of the Sensory Nerves on the Head.

SO, Area of distribution of the supra-orbital nerve. *ST*, Supra-trochlear. *IT*, Infra-trochlear. *L*, Lachrymal. *N*, Ethmoidal. *IO*, Infra-orbital. *B*, Buccinator. *SM*, Subcutaneous malæ. *AT*, Auriculo-temporal. *AM*, Great auricular. *OMj*, Great occipital. *OMi*, Lesser occipital. *CW*, Region of the central convolutions of the brain. *SC*, Region of the speech centre (third left frontal convolution).

I must have you remember for subsequent reference that the third division of the fifth nerve resembles a spinal nerve in having both motor and sensory fibres; that the first and second divisions of this nerve are purely sensory; that the sensory root of the nerve receives fibres from the grey matter of the spinal cord as far downwards as the middle of the cervical region; that the origins of the sensory root anastomose with the motor nuclei of all the nerves arising from the medulla oblongata with the exception of the abducens. This fact explains the vast number of reflex relations of the fifth nerve.

I will now show you the different branches of this nerve, which are easily seen upon this large diagram which I have drawn from Landois and Stirling; and if you look at this skull you can see the point of exit of each division, namely, the supra-orbital, the infra-orbital, and the mental, dividing into branches to supply the different sensory areas to which I have just drawn your attention.

I want to interest you a little more deeply in the connections of this very complex nerve. Let me explain to you the five ganglionic enlargements, or rather four, because we can exclude the great ganglion of Gasser.

The first ganglion is situated within the orbit, and is called "ophthalmic," "lenticular," or "ciliary." It gives off the ciliary nerves to the iris, and the muscle of accommodation of vision.

The second is called "Meckel's Ganglion," or "spheno-palatine," and sends branches to the orbit, nose, and soft palate. It lies in close relation with the superior maxillary nerve.

The third is called the "otic ganglion," and lies upon the inferior maxillary nerve below the foramen ovale, and sends branches to the two tensor muscles, namely, the tensor palati and the tensor tympani, and is thus physiologically associated with the acts of hearing and deglutition.

The fourth is called the submaxillary, since it lies above the submaxillary gland.

I do not wish to enter into any detail of the many connections of these ganglia, but unless you have some general idea of them you can scarcely comprehend how by massaging the head, and so influencing the sensory peripheral fibres of the fifth nerve, you are really inducing changes which we believe are of a nutritional nature in the ganglia themselves and their various relations. You will see, I hope, that some knowledge of this kind, no matter how superficial it may be, presents advantages of considerable importance.

The sensory root of each of the four ganglia is derived from this fifth nerve, the motor root is derived in three cases out of four from the seventh cranial nerve, and finally, the sympathetic branch comes from a plexus upon some neighbouring blood vessel.

I am not going to weary you with any further observations concerning the anatomy of the fifth nerve, but I cannot leave the subject without drawing your attention to the cervical ganglia of the sympathetic in the neck, and particularly to the superior cervical ganglia.

Here you see it is well shown, and observe that it is in direct connection with the four upper cervical nerves. The internal carotid artery is seen here. Please note how the branches from this superior sympathetic cervical ganglion traverse the surface of this vessel and send connections to the different ganglia to which I have just drawn your attention.

If we stimulate by massage or galvanism the peripheral ends of the cervical sympathetic we produce a marked effect upon the blood vessels going to the brain, and either diminish or increase the calibre, bringing about at the same time dilatation of the pupil.

Remember also that the same effects are induced by masséeing the spine between the shoulders as low down as the second dorsal vertebra, where exists the centrum cilio-spinale inferioris. The connection between this centre and the sympathetic takes place, as Budge and Claude Bernard have shown, through the communicating branches of the anterior roots of the spinal nerves; the four upper cervical roots of which are connected directly with the superior cervical ganglia, as I have just shown you.

Voisin has stated that besides the connection by means of these communicating branches, still another exists, certain filaments of the emerging spinal nerves surround the vertebral artery, anastomose with the carotid plexus in the cranium, and so reach the sympathetic root of the ciliary ganglion. But this is denied and disproved by the experiments of Eulenburg and Guttman, who state that Voisin's assertion can raise no claim to their consideration, especially as it is quite unsupported by descriptive anatomy.

"According to Claude Bernard the vaso-motor nerves of the head which influence vascular-thermic effects have their origin in the spinal cord, but not from the same spot as the oculo-pupillary branches. Section of the anterior roots of the two first dorsal nerves gives rise to contraction of the pupil with flattening of the cornea, narrowing of the palpebral fissure, retraction of the globe, but no dilatation of the vessels of the head, and no elevation of the temperature of the head. Division of the ascending filaments of the thoracic sympathetic between the second and fourth ribs, on the other hand, produces only dilatation of the vessels and elevation of the temperature of the same side, whilst the oculo-pupillary phenomena do not appear. Bernard, therefore, came to the conclusion that the centre for the oculo-pupillary and the vascular-thermic filaments of the cervical sympathetic are at different points in the spinal cord, and that the latter branches issue from it at the level of the third and fourth dorsal nerves by means of the communicating branches. Although recent investigations have placed it beyond doubt that the vaso-motor centrum for most parts (including the head) is in the medulla oblongata, nevertheless there may be ganglionic centres for vessel contraction placed in the periphery, in the walls of the vessels themselves, or in their immediate neighbourhood."

I have called your attention to this point for this and for other reasons to show you that by massaging and galvanising the spine you are exerting an influence upon heat and vascular centres concerned in the nutrition of parts distant from the spinal cord itself. Do not forget, if you please, that this lecture treats of massage of the head, face, eyes, ears, neck and throat, and that thus far my object has been to direct your attention to the head and neck, inasmuch as those parts are acted upon by the fifth nerve and the three cervical ganglia of the sympathetic, with regard to their sensation, their vascular and heat supply, and their nutrition. These are of course points of great interest and importance with which you ought to be familiar. We have to deal firstly with derangements or functional changes in the fifth nerve, or to reflex irritations. Sir J. Paget has reported a case where the hair of the entire scalp had turned white after a severe attack of neuralgic headache, and Anstie has reported a case where the hair of the eyebrow alone became blanched from pain in that region dependent upon the supra-orbital nerve. Hilton reports a case where the hair of the temple from the irritation excited on the dental branches of the fifth nerve through a decayed molar tooth became suddenly grey, and another where an obstinate form of ulcer, in the auditory canal, which was very painful and had withstood all methods of treatment, was cured by the extraction of a decayed tooth in the upper jaw.

The removal of teeth for severe neuralgias of the face and even for blindness has been known to cure the disease. In a paper which I had the honour of reading before the Odontological Society in the earlier part of this year, I endeavoured to show the undesirability of extracting teeth in some cases of neuralgia of the fifth nerve.

I will at once draw your attention to massaging the head and neck for headaches, and particularly for migraine and hemicrania. You will, after the description I am about to give you of these headaches, comprehend why I have been desirous to make you in a way acquainted with the ganglionic connections of the fifth nerve. Romberg was the first to associate hemicrania with painful affections of the brain, distinguishing it from the various peripheral neuralgias by calling it "neuralgia cerebralis." I do not think from my own experience that this sharp line of definition between mere hemicrania and neuralgias of the fifth nerve can be maintained. "Functional headaches are neuralgias of the fifth nerve," and hemicrania is the most typical example. Whether the disease is one of the fifth nerve primarily, and of the sympathetic secondarily, or *vice versa,* is open to dispute, and I for one cannot come to the conclusion that it is essentially due to the sympathetic nerves. The great physiologist, Du Bois-Raymond, who was a martyr to migraine, inferred that it was caused by tetanus of the muscular coat of the vessels on the affected side of the head, or, in other words, tetanus in the region supplied by the cervical part of the sympathetic nerve. He found that during the attack the temporal artery of the painful side was hard and cord-like to the touch, while that on the opposite side was in its normal state. On the affected side the face was pale and sunken, and the eye small and injected. The pain was increased by everything which raised the blood pressure in the head (as stooping, coughing, &c.), this increase being synchronous with the pulse in the temporal artery. Towards the end of the attack the ear also became warm and red.

These phenomena, the state of the temporal artery, the bloodlessness of the face, the sunken appearance of the eye, show that the muscular coat of the vessels of the affected side of the head was persistently contracted. On removal of the cause which produces this condition of tonic spasm, relaxation follows the over-action of the unstriped muscular fibres, and the walls of the vessels yield more than usually to the lateral pressure. This secondary relaxation explains the congestion of the conjunctiva and the redness and increased temperature of the ear which occur when the violence of the attack begins to subside. The vomiting and flashes of light before the eyes which frequently accompany this form of headache are caused by sudden changes in the intra-cephalic blood pressure. From these marked signs which I have just brought before you we have evidence of the most undisputed kind that the vascular spasm on the affected side of the head must have its origin in the sympathetic ganglion or nerve of the same side, or in the medullary centre of the sympathetic fibres involved, even as low down in the spinal cord as the cilio-spinal centre, which, if you remember, I told you was on a level with the second dorsal spine. If these spines are examined during an attack of migraine they will be frequently found extremely painful upon pressure, the pupil on the same side will also be found dilated, and an elevation of the pulse is frequently noted, as well as considerable increase in the quantity and tenacity of the saliva. If you examine this diagram again you will see that the submaxillary gland receives its fibres of secretion from the sympathetic, and possibly from the otic ganglion. Of vascular changes in nearly all and every form of headache there is in my mind very little doubt, therefore the conclusion may be admissible that their origin is in the sympathetic nerves and ganglia. In confirmation of this, if the eye on the painful side be examined by the ophthalmoscope during an attack, the central vessels of the eye are seen to be dilated, the veins sometimes being knotted and convoluted, whilst the vessels on the non-painful side are normal.

Eulenberg and Guttman state that there are cases of hemicrania which are entirely opposed in character to that of Du

Bois-Raymond's, that is to say, in which the striking symptoms are not those of spasms in the vessels, of arterial tetanus in the parts supplied by the cervical sympathetic, but those of relaxation of the vessels, of arterial hyperæmia caused by a loss of energy in the vaso-motor nerves. These are cases that one might designate hemicrania neuroparalytica or angioparalytica, as opposed to Du Bois-Raymond's "sympathicotonica."

Vaso-motor nerve centres, as we have noted, exist in the medulla oblongata, and it is reasonable to conclude that during an attack of severe headache this important part of the nervous system is more or less irritated, which gives rise to the shiverings, coldness and lividity of the extremities, and suppression of perspiration during the paroxysm. With regard to the pain or ache of the head during these attacks, Du Bois-Raymond has suggested that "the state of tonic spasm of the unstriped muscles of the vessels may itself give rise to pain, just as it is felt in striped muscular fibre, in cramp of the calf of the leg and in tetanus, or in unstriped muscular fibre in the uterus during labour pains, and in the intestines during an attack of colic." Probably this pain comes from pressure in the nerves of sensation distributed within the muscular tissue, and thus affords a reasonable explanation for the observation that pain is increased along with the blood pressure. We have every reason to conclude that the nervi nervorum of Marshall and Horsley and the sensory nerves are disturbed and excited by changes in the diameter of the accompanying and surrounding blood vessels, especially when these changes occur with some degree of suddenness. Anomalies of the circulation generally, and anæmia especially, have long been recognised as important causes of neuralgia.

I have said more about the nerve physiology of these headaches than I otherwise should do, as I earnestly wish to impress upon you the relationship of the second, fifth, and ninth cranial nerves with each other and with the sympathetic ganglia of the neck. Incurable as these headaches are usually considered, I assure you that within the past three years, since I have given so much attention to the application of massage and electricity, my success in the treatment of these affections has really astonished me.

Now before I show you how to massage and to galvanize the head for these headaches, I am anxious to make you acquainted with a few other forms of disease where these modes of treatment are extremely beneficial. The first is exophthalmic goitre—Basedow's disease, Graves' disease. Let me tell you at once that this disease when it occurs in people over sixty is as a rule incurable and shortens life. On the other hand, in young people, the prognosis is hopeful. We have an exceedingly interesting case now under treatment, where the neck is fast resuming its natural contour. I cannot do better than recall some of the more prominent symptoms and signs of this patient, whom I now show to you, although the signs presented by her are mere traces of what they were when she first came under our notice. She is of fair complexion, twenty-five years of age, and has suffered from epileptic fits; her intellect seems rather obtuse, and her temper is variable and irritable. She will tell you that she is weakly, easily becomes tired, loses her breath upon exertion, and suffers from violent palpitation of the heart, especially upon ascending the stairs. Systolic blowing murmurs can be heard over the innominate and subclavian vessels; there is also increased arterial tension, and the pulse beats are over a hundred per minute. The eye-balls are prominent, and the upper lid insufficient to cover them. When she looks down, as in reading, you see that a part of the cornea remains uncovered. If you observe the neck, which is unusually long, the lateral lobes of the thyroid gland are seen to be large, though they are not by any means as large as they were. If you grasp the gland in this way you will find that it lies somewhat deeply in the neck, and in massaging this gland you must not forget this; you must work deeply into the structures with the neck slightly flexed. Of late years it has been experimentally noted that the thyroid gland forms a very important link in the chain of nutritional and metabolic agencies.

It is now generally admitted that this disease is due to some functional disturbance in the cervical sympathetic. It is bilateral, rarely if ever unilateral, so that it differs from migraine in this respect. But, as in migraine, the oculo-pupillary fibres of the cervical sympathetic (centrum cilio-spinale) are in a state of irritation. I refer to this because, as in other affections supposed to be due to the sympathetic nerves, we must always remember to use spinal as well as local massage.

I must now, please, call your attention to aural vertigo—labyrinthine vertigo—Menière's disease, which usually depends on some derangement of the auditory nerve, probably of the nerve endings in the labyrinth. It is almost invariably associated with giddiness, sometimes slight, sometimes severe. Oftentimes there is intellectual confusion, rarely absolute loss of consciousness; it may be associated with distinct sense of nausea. Its onset is usually sudden, lasting for a few seconds, or very much longer. There is usually some defect of hearing, which is one-sided. Tinnitus is usually present, often it is persistent, distressing and harassing. These strange noises in the head are of the most varying character, resembling the hissing of steam as it issues from the kettle, the roaring of water as from a waterfall, the shrill whistle of a steam engine, the muffled sound of distant thunder, the jingling of bells. Perhaps the most common form is the rumbling murmur experienced by putting a shell to the ear. These sounds are of varying intensity; they may be high-pitched or they may be low-pitched. In my experience this disease is more common in the middle and advanced periods of life. Menière's disease is often associated with a gouty habit of body; sometimes it occurs in persons who are otherwise in good health, but this is not usually the case. There are generally indications of functional nerve troubles and nervous exhaustion. Whatever may be the change in the auditory apparatus, such as the nerves of the ampullæ or of the semicircular canals, one of its predisposing causes is shock to the nervous centres, or overwork, worry, or profound and intense anxiety. You may perhaps remember the case of a woman forty-seven years of age who received very decided benefit from massage and the continuous galvanic current when drugs utterly failed to relieve her. Her tale was that she had suffered from nervousness since the birth of her last baby six years before, but some time previous to this the right eyebrow and lashes became suddenly quite white. She was partially deaf in the left ear, and complained of noises in it and the left side of the head like a distant waterfall; and in the right ear the sounds were like a railway train coming through a tunnel at full speed. They were so distressing that she felt as though she were going out of her mind. They were worse at night when she was alone, but when engaged in conversation she scarcely heard them at all. Sometimes she suffered from giddiness for weeks, and had strange sensations and severe headache at the back of the head. At times the noises quite unnerved her and prevented her doing her household duties.

I have notes of many similar cases. A gentleman, a solicitor by profession, consulted me on account of what he called his strange attacks. He was an unusually strong man, in active work, over sixty years of age. He would be seized quite suddenly with a feeling of giddiness, and down he would go, unless he had time to take hold of something firmly to support himself. But what was somewhat peculiar was that if the attack of giddiness came on whilst he was sitting in the chair he would glide out of it upon the floor. He also had singing noises in the ear with some deafness.

A few months ago Dr. Snow, of Bournemouth, sent a lady to consult me suffering from Menière's disease. She was a highly nervous woman, and complained of attacks of giddiness, severe neuralgic headaches, deafness of the right ear, and vomiting. She had consulted several distinguished aurists, who told her that her deafness was of a nervous character, and that local treatment would be of no use to relieve her.

I informed her that I could cure her of many of her nervous symptoms, such as her headache, giddiness and vomiting, but I could not cure her deafness, and it was very doubtful if I could cure the noises in her head. However, after six weeks of massage and galvanic treatment, all the symptoms left her, except the deafness, which remained as bad as before. Every physician knows how difficult these cases are to relieve, not to say cure. Of course many are due to some chronic change caused by gout or syphilis, but the majority are functional, and are more readily relieved by massage and the continuous galvanic current than by any other form of treatment with which I am acquainted.

I cannot speak from other than a limited personal experience of the effects of massage upon the eye-ball itself, but Dr. Graham seems to have given considerable attention to this subject, and as opportunities arise I hope to test its effects. Cases have been reported of keratitis and corneal ulcers which have been cured by massage. There are three classes of visual defects occurring in young people, in which I feel sure that spinal massage from a physiological standpoint ought to be productive of great benefit. I refer to (1,) Decrease of the range of vision, short-sightedness (myopia). (2,) Decrease of the acuteness of vision (amblyopia). (3,) Decrease of the endurance of vision (asthenopia). Dr. Liebrich, the consulting ophthalmic surgeon to St. Thomas' Hospital, was known to have very decided views as to the cause of these conditions in young people, and in the year 1885 he gave two very interesting lectures, entitled "School life in its Influence on Sight and Figure," and he has often surprised a parent with the remark, "There is really nothing the matter with the child's eyes, it is the child's spine that is at fault."

I certainly believe most thoroughly in the views of this celebrated oculist. The centrum cilio-spinale which, as we have seen, is situated in the spinal cord, on a level with the first and second dorsal spines, communicates with the sympathetic through the branches of the anterior roots of the spinal nerves, and so passes along the internal carotid artery to the ciliary ganglion, there meeting with the trophic fibres, which come direct from the Gasserian ganglion. If the constrained posture which desk-work must inevitably produce does not lead to positive spinal curvature it certainly has that tendency, and this, to my thinking (of course, I may be quite wrong), sets up from undue strain an irritability of the cervical sympathetic leading to functional defects in the eye, which is not only subjected to considerable vascular tension, but also frequently to very abnormal sight. Of course the ophthalmic and orthopædic surgeons are thoroughly acquainted with these anatomical and physiological relationships, but I fail to see in the literature of these branches of medicine that amount of attention paid to these conditions which I think they deserve. The oculist naturally, possibly wisely and scientifically, has recourse to glasses, the orthopædic surgeon to some form of mechanical appliance; but in my humble opinion massage to the spine is far to be preferred to either. In my lecture on lateral curvature I shall again refer to this subject.

Dr. Graham says that Pagenstecher, of Wiesbaden, seems to have been the first ophthalmic surgeon to use massage upon the eye-ball after Donders had recommended it, but apparently independent of this recommendation. In one case that for twenty years had been subjected to periodical attacks of inflammation of the eyes, presenting an affection of the whole sclera, with uniform conjunctival and sub-conjunctival injection to a considerable degree, the conjunctiva of the globe slightly œdematous, with here and there at the margin of the cornea small round or oval prominences, not unlike the formations which are described as cystoid cicatrices. By the use of massage he succeeded in suppressing the attacks in their first stages. Immediately after the massage, diminution of intra-ocular pressure was observed in this as in other cases. Pagenstecher also used massage in a case of episcleritis, and in another of parenchymatous keratitis of specific origin. His method of using massage was by moving the lids, under slight pressure, in a radial direction from the centre of the cornea as quickly as possible, and after this by making circular friction under slight pressure upon the upper lid around and upon the region of the sclero-corneal margin. His idea was that massage might succeed in removing hindrance to the circulation, and in this he was not disappointed, as it emptied the blood vessels and lymphatics at the sclero-corneal margin, and thus promoted rapid absorption of exudation around them. He employed massage once a day from two to four minutes, and sometimes twice daily when it was well borne; and he often used a small quantity of yellow precipitate ointment under the lids, which made them glide more easily over the eyeballs, besides distributing and dividing the ointment in the finest possible manner, so that its specific effect would be greatly developed. The experience of Pagenstecher has been confirmed by many oculists, much to their agreeable surprise.

Panas practised massage and found it painless, speedy, and agreeable. In his hands, used together with precipitate ointment, in chronic affections of the cornea in young people, it was of great service, and it proved particularly effectual in parenchymatous and scrofulous keratitis and pannus granulosus.

Spasms of the facial nerve, when not due to organic disease and the so-called "habit-spasms," are very troublesome conditions, and do not as a rule yield to ordinary forms of treatment. They are often cured by massage to the head, neck, and spine when used in conjunction with a weak, stabile voltaic current (uninterrupted), the anode (sponge electrode) over the seat of spasm. The current, very weak (from six to eight milliampères), should be continued for ten or twenty minutes. The positive current seems to have a soothing influence: the kathode should be placed at the back of the neck.

The case which I now show you is one of torticollis, commonly called wry neck. This patient was sent to me by Dr. Macpherson Laurie, of Weymouth. You see how the head is drawn downwards and slightly backwards to the left side, and how the trunk of the body inclines in the same direction. She will tell you that at times the body seems to be drawn into that position.

The spasm is of the tonic kind, very persistent, and frequently gives her great pain. The cause is not very apparent. The affections came on about two years ago, and until she commenced the massage treatment with the combined voltaic and faradic currents nothing did her any good. Now, you see, she has considerable voluntary power, and can raise the head and maintain it for some time in a nearly erect posture. If you examine the right sterno-mastoid muscle it feels rigid, and it is curved and unyielding. I certainly get better effects from the combined current than I do from either of the currents applied singly. It seems as though the splenii were involved in the spasm as well as some of the anterior fibres of the trapezius, and I can scarcely believe that the rectus and obliquus escape altogether. It may be of an hysterical nature, but I doubt it.

Facial paralysis, of which you have seen several cases under treatment, readily yields also to massage and the combined current, certainly much more readily than do cases treated by galvanism alone.

Let me call your attention briefly to this case of tic-douloureux (trigeminal neuralgia). This patient was sent to me by Mr. Reece. Her history is that the attacks of pain and spasm came on about seven years ago, and from that time to the present she has rarely ever been free. I wish you to compare her condition now with what it was when she came under treatment six weeks ago. At that time, if you remember, she would be seized with violent paroxysms of pain and spasm every three or four minutes. She would hold and rub the right side of her face and head with a frantic look of the deepest agony. The attack was scarcely over when it would be renewed. The attacks came on during the night and awoke her out of her sleep, so that she got little rest; they came on during eating with intense severity, so that she was nearly starved; they came on when engaged in her household duties, so that she was obliged to relinquish them altogether; in fact she was driven to a state bordering on distraction. The pain began in the ethmoidal sensory region of the fifth nerve, and then shot across to the lachrymal and supra-orbital. She had seven teeth drawn at one sitting, but this did not relieve her in the slightest degree. Now she has not had an attack for a week; she sleeps and eats well, and as she truly says, she feels quite a different being, thanks to the massage and galvanism.

Now let me draw your attention to the manipulations for the

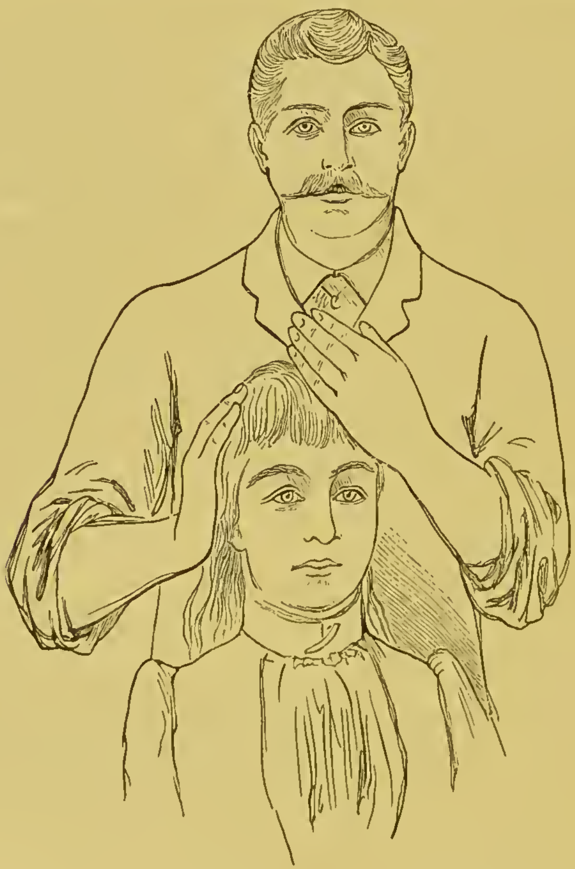

Fig. 17 illustrates the ordinary method of masséeing the head, effleurage. One hand of the operator is carried over the mastoid portion of the temporal and upwards to the vertex of the head, whilst the other hand is carried over the opposite frontal eminence. Both hands are so directed that they meet each other at the top of the head.

head, neck and face. I seat the patient upon this stool and stand behind it, and work my hands upon opposite sides of the head (*Fig.* 17).

First: I place my right hand firmly upon the occiput and mastoid process of the right temporal bone, whilst my left hand is placed, thus, upon the temporal bone and external angular process of the orbit. Both hands you see now traverse the head to meet each other upon the vertex; my right ascends upwards over the parietal bone to meet my left hand which is carried over the superciliary ridge and left frontal eminence of the frontal bone. These movements must be made firmly, and if well done the pressure of the one equalizes the pressure of the other, and so the head is kept vertical upon its balance. You see I now perform precisely the same movements, but they are reversed, the left hand is now working in the same way that the right hand was before.

Second: This movement requires a little practice, which I will show. Place both your hands at the back of the head in the occipito-mastoid regions respectively precisely after this manner; carry them both upwards and forwards on each side over the temporo-parietal regions, then continue onwards and forwards, each hand over the supra-orbital ridges and frontal eminences; then cross and work from before backwards over the vertex, so; now recross the hands and carry the movements right and left hand behind the right and left ramus of the jaw downwards over the sterno-mastoid muscles into the root of the neck. Do not remove the hands, but work them up the neck, the heel of the hand being followed by the fingers; work the fingers well into the sub-occipital spaces and posterior triangles of the neck; then commence and repeat the movements as before. I make these movements more or less firmly from first to last.

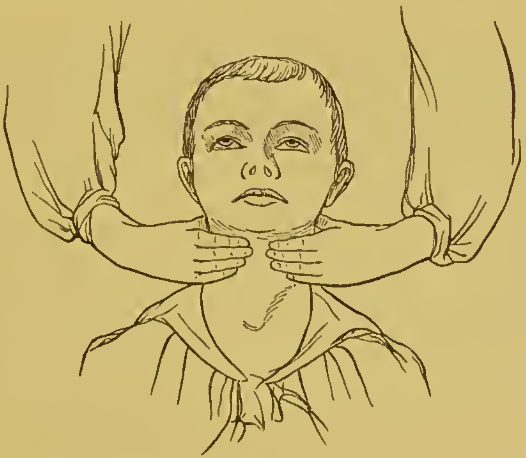

Fig. 18 gives a diagrammatic representation of a common method of masséeing the neck, effleurage and petrissage.

I now make them lightly, after this fashion, passing my fingers through the hair. Again, I walk over the scalp with my fingers, thus, the hands and fingers going in reverse directions. I now leave the head alone and manipulate deeply into each triangle of the neck. You observe my movements are lateral and rotatory (*Fig.* 18). I can thus manipulate the cervical sympathetic ganglia and the glands and lymphatics, the vagus, laryngeal and other nerves, and the submaxillary and thyroid glands.

Third: We place the patient in the horizontal posture with the face upwards, and you will find that for some purposes this is more convenient, especially for manipulating upon the eyes, and the fifth and facial nerves. The thumbs are better than the fingers for the eyeball massage.

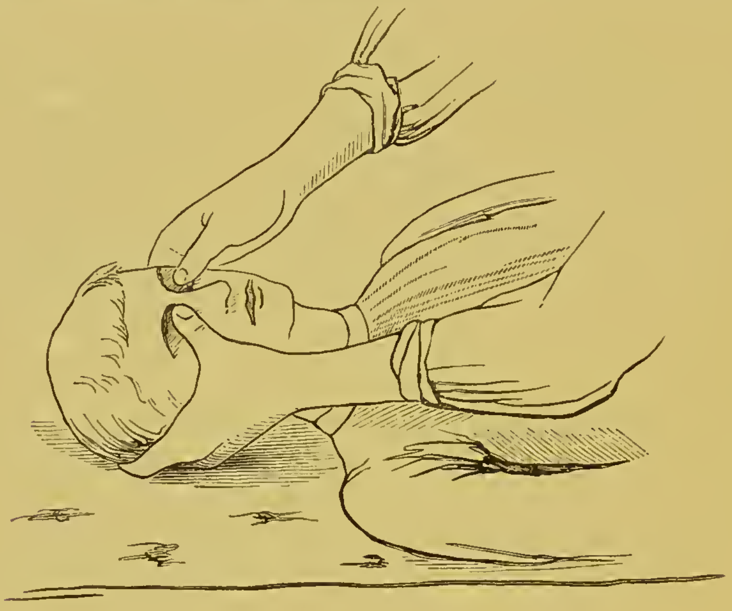

Fig. 19 illustrates the method adopted for effleuraging the upper lid and the eyeball. Care must be taken to place the thumb exactly in the middle of the lid and to rotate them bilaterally. Considerable friction and even pressure can be applied when required.

If a little tact is used this process will neither be irritating nor painful, but care is required not to touch the eyelashes. Considerable pressure, slowly and gradually applied, can be exercised with very good effect. The head is now in the best position for performing soothing, tranquillizing and hypnotizing manipulations; these belong entirely to the effleurage class, and are performed lightly in the direction of the supra-orbital nerves, in the same way that we manipulate for brow ague and supra-orbital neuralgia.

I conclude this lecture by drawing your attention to a process of manipulation which I style gymnastic massage of the larynx for throat deafness, which you know is so common.

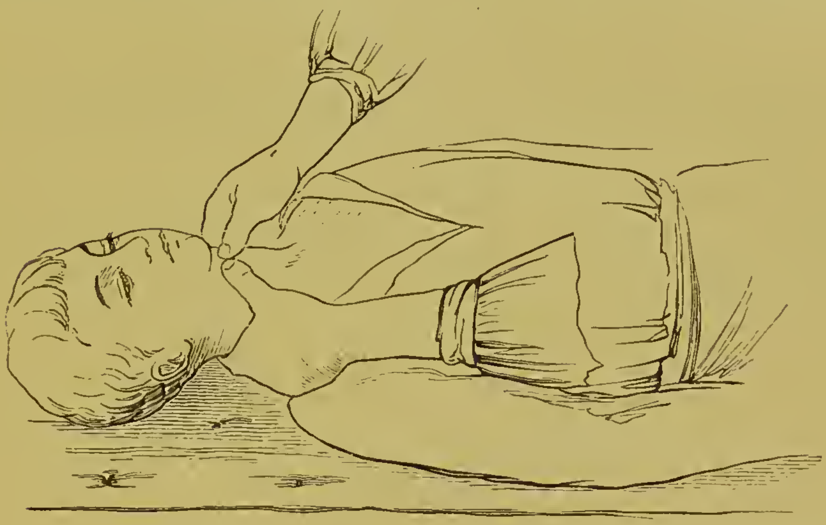

Fig. 20 illustrates the position of the thumbs at the cricoid end of the thyroid cartilage for massaging the larynx and effecting laryngeal gymnastics in throat deafness.

I place my thumbs at the lower border of the thyroid cartilage, and I then ask my patient to swallow; of course in the act of swallowing the larynx is raised, my thumbs follow the larynx as it ascends, and when it can go no higher I fix it in this position, and I again request my patient to make every effort to swallow, and by this means the Eustachian tube is frequently cleared of its contents, and the hearing is greatly improved.

Lecture IV.

MASSAGE AND INDUCTION, FARADIC MASSAGE OF THE SKIN.

The value of Effleurage and other manipulations upon the skin, which we look upon as a medium of connection of the various sensation processes—The resisting power of the epidermis in health and disease—The epidermis as an insulator—The epidermis and peripheral nerves a gauge to the activity and correlative integrity of the brain centres and reflex acts.

I HAVE told you that my definition of the term effleurage is to stroke lightly, to bring surface to surface. Two surfaces may be brought into superficial contact with considerable velocity without either experiencing great resistance; nevertheless friction is induced of a kind relative to the mode of energy expended. Light friction movements are often productive of more active physiological effects than are movements of a more definite and decided kind; we measure the kinetic influence which results according to the impress which is made, not only upon the peripheral nerves and blood vessels of the skin, but also upon the brain and spinal centres. The sensation produced by the impress of a feather upon the skin differs from that of my finger, and the effect upon the surface of the brain is of a distinct but different nature. The impress is synthetic as far as the skin is concerned, but it is analytic when appreciated by the sensorium; therefore I would say that the physical energy known as an impression becomes transformed into vital energy by the brain cells. It is the brain which converts an impression into a sensation. The phenomena of sensation is not a simple phenomena constituted by the mere reaction of a tissue in the presence of external excitations, it is the complex subordinated operation of the nervous activity which requires the participation of a great many organs successively brought into play in order to arrive at complete evolution. We have thus far, you see, built up a sensitive impression, originated in the peripheral nerves of the skin, and transformed by some psycho-intellectual operation into conscious sensation. I need scarcely say that conscious sensibility is manufactured in the grey matter of the brain and is associated with volitional response, provided correlative integrity reigns supreme. Unconscious sensibility, on the other hand, is of the dynamic order, and is associated with the more complex centres in the medulla oblongata, and gives rise to reflex and it may be unconscious acts. If, for instance, I energize by impress through the vibratory movements of tapotement the skin of your arm, I create a sensibility which is directly conscious, as well as unconscious: the impress goes straight to the brain, which converts it into conscious sensibility, but part of the impression is arrested either in the spinal cord or the medulla, which gives rise to unconscious sensibility experienced by the vaso-dilators of the blood vessels, the effect of which is to produce redness of the skin itself. Just remember, then, that it is by the terminal expansions of the nervous system spread out, so to speak, in a fine delicate network, the recipient of all that comes to impress it, that we are made sensitive, conscious, and even unconscious creatures, according to environment. I have not in this lecture to deal with the brain proper, except in so far as to show you that it is in direct communication with the skin, but this much I want to make clear to you for future observation, that in health those active sensory and sensorial impressions are constantly passing to the optic thalami and that they radiate from thence through the white fibres to the cortical grey matter of the brain. There must be integrity throughout the living chain of which the skin, nerve, and ganglionic centre are but links. Force, conduction and resistance must be of a definite and uniform standard in order that the moral, the mental and the physical may work together in unison, and I shall prove to you, and in fact show you by demonstration, that the skin is an index of the functional activity, not only of the lower, but of the higher nervous centres, 'conscious,' 'volitional,' 'unconscious,' 'automatic.' We all experience the fact that the higher the level of the nervous centre in direct communication with the skin, the more sensitive the skin becomes, the more rapidly is the impression received by the brain, and the less is it diluted in its transit. You must remember this on applying galvanism; and I shall shortly call your attention to these points when speaking of skin reflexes and perturbations of sensibility.

For the moment let me remind you that the skin consists of three layers of tissue: firstly, the epidermis; secondly, the chorium or cutis vera, with the papillæ; and thirdly, behind this a layer of fat. The influence of massage upon the skin by effleurage induces sensory, sensorial, and metabolic effects mainly through the nervous system, so I say, if you please, that these are induced effects, and so also, in degree, are the results brought about by tapotement. But petrissage movements act upon the various structures of the skin by direct pressure; the sebaceous glands which are frequently choked by sebum are in this manner relieved of their contents, and so are the sweat glands, the lymphatics and the blood vessels. The function of the skin is to eliminate principally carbonic acid and water, and to promote the exchange of gases by the absorption of oxygen. This form of cutaneous respiration is much more considerable in frogs and other amphibians with a *thin*, almost moist epidermis, than in warm-blooded animals; so that the skin is a more important respiratory organ in these animals than the lungs themselves. The dog, on the other hand, does not sweat, hence the activity of the pulmonary respiration. There exists between the skin, the lungs, and the kidneys, as excretory organs, a functional sympathetic relationship, through the medulla oblongata. As venous blood loaded with carbonic acid is the natural stimulant of the respiratory centres, so we may conclude that carbonic acid is the natural respiratory stimulant of the skin, and urea and uric acid the natural stimulant of the kidneys. These waste products, when normal in quantity, produce through the vaso-motor centres a healthy degree of arterial tonus; but when the vaso-motor centre is over stimulated we find as the result an excess of arterial tonus or morbid or high tension; and when this exists its influence is felt, not only in the functional activity of the skin, but in the tissues generally; and it is highly probable that massage exerts a beneficial effect by stimulating respiration of the tissues of the skin and thus relieves the medulla and vaso-motor centres of over-strain. One thing is clear, namely, that massage can advance as well as diminish arterial tension. It advances it when deficient by promoting respiration of tissue; it diminishes it when in excess by increasing metabolism and the elimination of carbonic acid.

Let me call your attention to the sweat glands of the skin. The amount of water given off by the skin is about two pounds in twenty-four hours (STIRLING). There are two kinds of perspiration, *insensible perspiration* and *sensible perspiration;* the former is evaporated at once from the skin, the latter collects in drops upon the surface. I am anxious that you should take sensible perspiration into consideration; it presents points of interest with which you should be familiar.

The influence of nerves upon the secretion of sweat is very marked. That sensible perspiration is healthful under certain given conditions is unquestionable, but this is not the case if it occurs when these conditions do not exist.

The man who sweats profusely, when his fellows under the same influences do not do so, is more liable to functional and even degenerative changes than others. "As in the secretion of saliva *vaso-motor nerves* are usually in action at the same time as the proper secretory nerves, the vaso-dilator nerves (sweating with a red congested skin) are most frequently involved. The fact that secretion of sweat does occasionally take place when the skin is pale shows that when the vaso-motor nerves are excited so as to constrict the cutaneous blood-vessels, the sweat-secretory nerve fibres may be active" (LANDOIS and STIRLING). It is to the latter class I refer, and I assure you they are more common than is usually supposed; and it is indicative of a want of tone, and a low degree of vitality of no small importance; it is always associated with a form of nervous exhaustion,—understand me, it is essentially neurotic, and is not unfrequently followed by organic change in the nerve centres leading to mental disturbance, diabetes, and albuminuria. There is a form of hyperidrosis, called by Eulenberg "epileptoid sweats": I think this form is very correctly named. A man will suddenly, after walking a few yards and without any apparently exciting cause, break out into a profuse perspiration, become pale, hungry and faint, and lose resisting power, without vaso-motor dilatation or constriction; indeed, it seems as though, for the time, the dilator and constrictor fibres were both paralyzed. The normal secretion of sweat diminishes along with other derangements of nutrition of the skin in some nervous diseases, and in degeneration of the motor-ganglia of the anterior horns of the spinal cord. In some cases the nutrition of the skin is interfered with in a peculiar way, so that it becomes glossy and has the feeling and appearance of parchment. I call your attention to these abnormal conditions of the skin in order that you may the more readily examine and make yourselves acquainted with the precise nature of every skin with which you may come in contact. Examine all skins prior to massage as to their hardness or softness, dryness or moistness, temperature and colour, fat and elasticity. Elastic fibres of the skin exist in the chorium and the papillæ, and smooth muscular fibres occur in the chorium in certain situations, on extensor surfaces (NEUMANN), nipple, areola mammæ, prepuce, and in special abundance in the dartos and the scrotum. The nerves of the skin form a dense plexus in the superficial layers of the chorium, branches from which extend into the epidermis. These nerves form by their termination end "bulbs" "the touch corpuscles," which lie essentially in the papillæ; they are most numerous in the palm of the hand and the sole of the foot, and in the fingers and toes.

In the sensory nerve trunks we find fibres which administer to *painful* impressions, and fibres which administer to *tactile* impressions. The sensations of *temperature* and *pressure* are also reckoned as belonging to the tactile group. Tactile sensations (including pressure and temperature) are only discharged from the coverings of the skin and the orifices of the body. Tactile sensations are absent from all internal viscera—pain alone can be discharged from these organs. It is necessary to remember that tactile nerves can only discharge a tactile impression or sensation of contact, while thermal stimuli are required to produce a temperature sensation, and in both cases the results are only obtained when the appropriate stimuli are applied to the end organs. Observe, for your special guidance, that strong stimuli disturb normal tactile sensations by over-stimulation and result in pain.

Dr. Brown Sequard believes that there are besides the four distinct kinds of nerve fibres of the higher senses at least eleven kinds of nerve fibres in the spinal cord and in the cranial, spinal and sympathetic nerves. He enumerates these eleven kinds as follows:

1.—Conductors of impressions of touch.
2.— ,, ,, ,, of tickling.
3.— ,, ,, ,, of pain.
4.— ,, ,, ,, of temperature.
5.— ,, ,, ,, of muscular contraction.
6.—Incitor-motor conductors.
7.—Incito-nutritive and secretory conductors.
8.—Voluntary motor conductors.
9.—Involuntary motor conductors.
10.—Vaso-motor conductors.
11.—Nutritive and secretory conductors.

We now know that there are many more nerve fibres than these directing and controlling function.

It must be within your experience to find that the tactile sense varies greatly in different individuals. The skin of a person may be under sensitive (*partial anæsthesia*) or insensitive (*anæsthesia*), or over sensitive (*hyperæsthesia*), or sensibility to pain may be absent (*analgesia*), whilst the sensibility to touch is present, or sensations may be perverted, hot objects feeling cold and cold objects feeling hot; or sensation may be retarded and then quite suddenly experienced as extreme pain. When perception of pain is delayed, that of temperature is delayed in like manner.

You have seen instances of these varying states of sensibility in some of the patients upon whom you have been operating. These conditions do not always indicate disease of the central nervous system; they are often found in states of nervous exhaustion, hysteria, and the like of these, "functional and nutritional diseases." We not unfrequently find intense pain in the upper limbs from the tips of the fingers to the elbow, and from the toes to the knees, with a subjective sense of numbness and deficiency of muscular sense, yet tactile impressions are normal. Such conditions are often found in women at the change of life, and they are quickly cured by massage and the galvano-faradic current, not only applied to the limbs, but to the spine and to the head. It is often the case that cramps of the muscles, of the calf of the leg and of the toes, likewise of the fingers, tingling, burning, and other abnormal sensations of a distressing character are experienced.

The reflexes of the skin are interesting, and it is well that you should know something concerning them. They may be absent altogether, or they may be excessive and very easily excited. You have seen the skin of the abdomen drawn into fold-like prominences when I have passed my finger nail over it. You are aware that in order to get a perfect reflex act there must be complete continuity between the afferent sensory or centripetal nerve with its centre (which lies in the spinal cord between the roots of the sensory and motor nerves), and the efferent or motor nerve by which the act is brought into operation. This constitutes the reflex arc. The stimulus so sent to the spinal cord, may, as I told you just now, travel on to the vaso-motor centre in the medulla, and from thence it may become impressed upon the brain and effect a conscious sensation, and these become identified with a volitional impulse.

These reflexes are named according to the part excited (pray do not be at all surprised if you get no cutaneous reflex, it is quite possible for it to be altogether absent), plantar reflex, gluteal reflex, cremaster reflex, abdominal reflex, epigastric reflex, lumbar, dorsal, scapular, and so on. Of course the reflexes of the eye are of the highest importance ; contraction of the pupil to light, accommodation, dilatation on stimulating the skin of the neck, etc.

I must now draw your attention to the epidermis or scarf skin, as it is called, and I think we shall find that the consideration of this structure is of interest to us from several points of view. It consists of many layers of epithelial cells united to each other by cement substance ; it varies in thickness in different parts of the body, notably the soles of the feet, where in parts it is quite horny. The superficial layers —stratum corneum—consist of several layers of dry horny non-nucleated squames, devoid both of nerves and blood-vessels ; the minor part of the epidermis which lies upon the true vascular sensitive chorium consist of many layers of nucleated protoplasmic epithelial cells, amongst which are sometimes found granular leucocytes or wandering cells, so that we see as we pass from without to within the epidermis there is a gradual approach to a highly-organised tissue. If the skin be dry the epidermis becomes an insulator, but its power of resistance is not complete ; occasionally, however, we find the skin of the back with thick layers of desquamating epithelium, dry and scurfy, resisting an ordinary galvanic current which would be painful if applied to the cheek or to the inner part of the thigh.

We take advantage of this resisting power of the epidermis in the employment of what I call *Faradic Massage*. You are using this form of massage daily, so it seems scarcely needful to say anything about it. However, I will draw your attention to one or two points, as the success of this mode of treatment depends to a great extent upon the manner in which it is employed. We use the faradic or induced current, and the effect is to produce an agreeable impress of a decidedly stimulating nature on the peripheral nerves of the skin. You may use the voltaic or continuous current just in the same way with the deep petrissage movements upon muscle, but I do not see any special advantage in this. The faradic current has first to overcome the resistance of your own body before it meets with the body of your patient; the current can in this manner be applied to any part of your patient's body, and I generally use it for the back and the head and neck. I may, when applying it to the head, throw in a moiety of the galvanic current, which certainly in some cases seems to be beneficial. I use the flat metal electrodes covered with chamois leather; it does not matter which pole is applied to your patient. The conducting power of the electrodes must be made complete by moistening them with the smallest amount of water, just sufficient in fact to make them damp; and remember we have to study resistance rather than conduction. The epidermis of your patient and that of your own hands must be as dry as possible. One electrode should be placed over the sternum of the patient, the other at your own neck just within the collar, so that your hands are left free for any movements you wish to perform. You may fasten one electrode to your arm if you like instead of placing it at the back of your neck, but I prefer, and always adopt, the latter method. It does not matter upon what part of the body you are operating, your movements must be as light as possible; they may be made with any part of the hand, but as a rule you will find the back of it answers better than the palm or the tips of the fingers. The current should never be conducted with sufficient force to produce muscular spasm either in yourself or your patient, and the great point to which you must attend is to maintain resistance and lessen the conducting power of the electrodes and the epidermis.

If the electrodes are too wet, or the skin of your patient or your own hand moist, you will quite fail to produce the effect desired.

In order to demonstrate the relative resistance of the epidermis as compared with the true skin make a scratch through the epidermis of your hand, and you will find a weak electric current produce such a painful impression that you will be unable to bear it, although when applied to the epidermis itself it is scarcely perceptible.

Thus far we are convinced that the conducting power of the epidermis is limited; that impressions which are called tactile would be really painful if this were not the case, so that the difference between tactile sensibility, common sensibility, thermic sensibility, and painful sensation is merely a question of conduction and resistance to impressions on the part of the epidermis.

Let us pass now from the resisting power of the epidermis to the consideration of another form of resistance which is common to a class of cases apart from hysteria. You have seen many such here under treatment. The patients are usually depressed, melancholic, and suffer from nervous exhaustion. They are also remarkably insensible to the faradic and galvanic currents, and this insensibility seems to be in proportion to the obtuseness of their mental powers; but it is interesting to note that as their mental condition improves so their sensibility to Faradism gradually returns to its normal state. Here we certainly have resistance in the nerves or nervous centres, or most probably in both, or it might be in the brain itself alone.

I have often noticed that this torpidity of intellectual power is associated with increased physical resistance to the faradic current and to the general sensibility of the skin. Of course in locomotor-ataxy and general paralysis of the insane this is a marked feature; but I am alluding now to cases where in most instances the patients are told that there is nothing at all the matter with them, and although we see that physical resistance is increased, we invariably find that moral resistance (will resistance) is below the normal standard.

We know that in the domain of intellectual activity proper sensitive impressions are of the utmost importance; but tactile impressions are specially destined to provoke reactions in the intellectual sphere, and these sensitive impressions we have already dealt with; they are not only associated with touch, contact and pressure of bodies, but they give us the idea of temperature and of the activity of our muscles.

These impressions unquestionably play a very important part in the cerebral activity (or otherwise) of a man's individuality. "We all know," says Dr. Luys, in his work on the Brain and its Functions, "how fine, delicate, and sensitive is the skin of women in general, and particularly of those who live in idleness and do no manual work; how their sensitive nervous plexuses are in a manner exposed naked to exciting agencies of all sorts; and how, from this very fact, this tactile sensibility, incessantly awake, and incessantly in vibration, keeps their mind continually informed of a thousand sensations that escape us men, and of tactile subtleties of which we have no notion. Thus in idle women of society, and men with a fine skin, mental aptitudes are developed and maintained in the direct ratio of the perfectionment and delicacy of sensibility of the skin. The perfection of touch becomes in a manner a second sight, which enables the mind to feel *and see* fine details which escape the generality of men, and constitutes a quality of .the first order, *moral tact*, that touch of the soul (*toucher de l'âme*), as it has been called, which is the characteristic of organizations with a delicate and impressionable skin, whose *sensorium*, like a tender cord, is always ready to vibrate at the contact of the slightest impressions.

Inversely, compare the thick skin of the man of toil, accustomed to handle coarse tools and lift heavy burdens, and in whom the sensitive pleasures are removed from the bodies they touch by a thick layer of epithelial callosities, and see if, after an examination of his intellectual and moral sensibility, you are understood when you endeavour to evoke in him some sparks of those delicacies of sentiment that so clearly characterize the mental condition of individuals with a fine skin. On this point experience has long ago pronounced judgment, and we all know that we must speak to everyone in the language he can comprehend, and that to endeavour to awaken in the mind of a man of coarse skin a notion of the delicacies of a refined sentiment is to speak to a deaf man of the deliciousness of harmony, and to a blind man of the beauties of colours.

To the facts we have already cited respecting the pathogenic influence exercised by certain anæsthesias upon the genealogy of certain forms of delirium, we should add as a complement the following observations reported by Dr. Auzony, which clearly show what a curious influence sensitive impressions may have upon psycho-intellectual phenomena in general. The case was that of a young man, clever and rational, who suddenly became undisciplined and rebellious to the utmost extent, and gave himself up to the worst tendencies, even to the compromising of the peace and honour of his family. Examination showed that he was completely *anæsthetic*. During his stay in the asylum he successively experienced several intermittent phases of anæsthesia, of which the appearance manifestly coincided with the return of his worst instincts. When sensibility reappeared in the skin, moral dispositions contrary to the preceding were observed to return in him, together with a very clear consciousness of his situation."

Some years ago I met with a case in which a young lady, aged about twenty-three, stated that she was totally unconscious of *sensations* of any kind. In all her life she had never experienced pain, "had never had a headache." Heat or cold, sunshine or fog, were all the same to her; nothing seemed to affect either her health or her spirits; she was uniformly calm, easy-going, imperturbable. She was married about a year after I first knew her, and to a lady friend whom she had known intimately in their days of school-girlhood, and who met her six or seven years afterwards, she said that her peculiarity had in no way changed. She was still insensible to pain, and during her three pregnancies had suffered nothing, even the critical periods of labour having been passed through without any physical distress. She was highly educated, musical, and pleasant in society; the only abnormality that her friend detected in her was her extreme coldness of manner in her own home to her husband and children; to the latter especially she was harsh and unreasonably exacting, and appeared totally devoid of the faintest rudiments of natural affection.

A case is known to me at the present time in which a young man, aged twenty-one, exhibits entire insensibility to the sensation of pain. He is quite willing at any time to demonstrate this to his friends on their expressing incredulity on the subject, performing for their entertainment a variety of unnatural feats, such, for instance, as running a darning needle through a finger or thumb, in at one side and out at the other, or pinning his hands to a table by means of four stout needles driven through the thin part of the flesh extending between the fingers and the fingers and thumb. About two years ago he underwent an extremely severe operation on one of his eyes, refusing to be placed under chloroform, and taking a conscious interest in the movements of the surgeons throughout the whole operation. I may mention that a very strong galvanic current produces but little impression upon him. He is a young man of peculiar temperaments, given to the exhibition of fits of violent anger and passion on quite inadequate provocation, which are succeeded by great sullenness and silence for several hours. He sometimes shows destructive tendencies, and will wantonly smash and spoil articles of value, although remonstrated with by his friends on the subject and begged to desist.

We now, I hope, know something about the skin and epidermis; the latter undoubtedly forms a valuable protective covering to the body. It is a bad conductor of heat, and thus acts as one of the factors regulating the radiation of heat.

It resists the action of electricity, and the solid, easily movable cutis affords a good protection against external mechanical injuries; while the dry, inpermeable, horny epidermis, devoid of nerves and blood vessels, affords a further safeguard against the absorption of poisons, and at the same time it is capable of resisting, to a certain degree, thermal and chemical actions.

By way of conclusion I should like to say a word or two to you about the absorptive power of the skin and the use of applications to it, either during or after massage.

Some deny that the skin has any power to absorb. This is a mistake. Mercury is readily absorbed and taken into the system through this medium. You know some skins are very course and naturally greasy, and where this is so I recommend the part to be well washed with a solution of eau de cologne and ammonia. I maintain that no form of unguent, fat or vaseline should be used during the massage process, with two exceptions, namely, to the abdomen and to the joints. After massage it is well in many cases to anoint these parts with some unctuous material, because it causes the heat and increased activity to be maintained.

Lecture V.

MUSCLE AND NERVE.

Physiological relationship of nerve and muscle—Disturbance of nerve function leading to motor, trophic, sensory, and sense derangements in muscle—The value of massage in central nervous affections, muscular atrophy, locomotor-ataxy, paraplegic ataxy, polio-myelitis, pseudo-hypertrophic paralysis; also in occupation cramps of muscle, rheumatic and gouty inflammation of nerves, cervico-brachial neuralgia, lumbago, sciatica, multiple neuritis, alcoholic and diabetic paralysis, chorea, etc.

You will remember in my former lectures I told you that all movements in the body were the result of muscular action, excepting ciliary and amœboid movement: That the especial property of muscle was its power to contract when acted upon by certain forms of energy or stimuli, the natural stimulus being sent to it from the nervous centres, the nerve being the rheophore or medium of conduction: That the integrity of voluntary muscular movement was dependent upon the integrity of the nerve cells in the kinæsic area of the cortex of the brain on the opposite side to the muscles which were being stimulated, and to the integrity of the nerves as conducting agents, rather than to the integrity of the muscles themselves: That the nerve cells in the motor area of the hemispheres had a small sensory equivalent when compared to their large motor equivalent: That the axis cylinder of most nerve fibres is continuous in one direction with the process of a nerve cell, and may be looked upon as a prolonged process of the cell showing its stages of exaltation and depression, and also its functional and nutritional defects: That muscular sense and tactile sensibility were likewise located in the kinæsthetic area: That there were two prime levels for the liberation of energy, the one volitional, situated in the grey matter of the cortex, the other automatic, and situated in the bulbo-spinal axis: That the centres of the lower level had an existence of their own, but that these centres were subordinate to the centres of the higher level: That muscular tone was dependent upon the vitality of the nervous centre and its connection with the muscles: That the conducting power of the nerve was inversely to the resistance that the stimulus had to overcome in its transit: That pain, spasm, and cramp in muscles were due to over excitability on the part of the nerve cell, or to defective resistance on the part of the nerve or muscle producing undue tension and pressure in the muscular fibrillæ: That the generation and transit of a stimulus was equivalent to the work which it had to perform: That the stimulus travelled in a regular and rhythmical manner: That a nerve fibre enters each muscular fibre, and where it enters it forms an eminence, the "motorial end plate": That muscular tissue had an "independent excitability," which was inherent in certain constituents of the sarcous substance, so that a muscle may be made to contract directly by a stimulus acting upon itself, as well as indirectly by an impulse sent to it through its motor nerve: That the degree of contraction of a muscle depended upon the strength of the stimulus, the contractile power of the muscle after a time becoming exhausted, even though the stimulus continue of the same strength: That the direct as well as indirect stimulation of a muscle is productive of phenomena with which we ought to be acquainted in subjecting a muscle to the galvanic or faradic currents.

I referred in my first lecture to the metabolism of muscle and to the oxidation and respiration of tissue, and if I remember rightly I also told you that these changes were always increased by muscular contraction. Let me now show you the effect of electric stimulation of a muscle and of its nerve, in health and in disease, and from what I have just told you I am quite sure you will follow my experiments with some amount of knowledge and interest.

In this patient I have a case of atrophy of the deltoid muscle. If you compare the right shoulder with the left you cannot fail to observe a very marked and striking difference. You see the left shoulder is rounded, and of natural contour, and if you place your hand upon it you will feel a well developed and firm deltoid; this condition is absent on the right side: instead of rotundity and uniformity we have flatness and irregularity. You see the acromion process of the scapula projecting, of a somewhat square outline, and you can push your fingers well upon its under surface; the muscle feels like a flat band. I now tell the patient to raise the left arm, which he does with perfect freedom; but observe how vain and ineffectual are his efforts to raise the right arm. There is some apparent power, but this is only apparent, for the shoulder and scapula are raised by the trapezius. If you press firmly upon the scapula and clavicle, in this manner, there is evidently no power whatever to abduct the arm. If you feel the arm you will find considerable wasting of the biceps and triceps muscles, but this is in a measure due to disuse, rather than from the primary cause which has brought about this change in the deltoid. I believe the change to be of central origin, anterior polio-myelitis of the lower cervical portion of the spinal cord; it came on with acute symptoms—fever, high temperature, great pain, and some delirium; these have passed away, the storm has calmed down, and we are going to investigate the wreck to see what remains of timber, spars, and rigging. It seems to me that this is an excellent opportunity to demonstrate to you the effects of the induced and continuous electric or galvanic currents upon nerve and muscle, in a healthy and in a diseased state.

I have told you that muscle can be excited by stimuli independently of nerve; but in the living subject where we find muscle and nerve in conjoint union and in a healthy condition, the stimulus applied to muscle will be direct, in as far as the muscle is concerned, but will act directly upon the nerve, the nerve being the excitable and exciting agent. If the continuity of the nerve fibres be destroyed or deranged, the conduction of the impulse is either interrupted or destroyed.

There is an important practical deduction to be drawn from this fact. Strong stimulation causes fatigue in a healthy nerve. Too strong stimulation of a fatigued or diseased nerve may utterly and irreparably destroy its conducting power, no matter whether the stimulus be mechanical or electrical.

An electrical current acts most powerfully upon a nerve at the moment when it is applied and at the moment when it ceases.

If a constant current be applied to a motor nerve the greatest effect is produced when the current is closed (closing shock) and when it is opened (opening shock), if it be applied as a stimulus to a sensory nerve the effect is most marked at the moment of breaking the current.

We will, if you please, operate upon the healthy deltoid muscle, first with the faradic current, and then with the continuous current; note the reaction, and compare it with the same muscle of the opposite side.

I now place this flat electrode (anode from the faradic battery) upon the vertebra between the shoulders, and this carbon-covered electrode (kathode) upon the healthy deltoid muscle; you see the arm is raised by the stimulus so applied. I now make and break the current by moving the hammer with my finger; you will observe that no shock is felt on making the current, but only on breaking it, when a single contraction occurs. When the hammer vibrates rapidly, as it does now (about fifty times a second), the muscle remains contracted during the whole time of the flow. I now place the carbon-covered electrode upon the diseased or wasted deltoid muscle, and I get no shock, no muscular contraction. Let me increase the strength of the current. I now, you see, get some muscular contraction, though it is very slight, so little in fact that I might say faradic excitability in this muscle is lost. Now let us see what will be the effect upon each muscle by the application of the continuous or galvanic current. I place the galvanometer in circuit, and use a current of eight milliampères, which I apply to the healthy muscles by means of my carbon electrode as before. If you look at this battery you see I have here what is called a current reverser, and by this means I can alter the polarity of the current without removing the electrode. You see now the current is broken, there is in fact disconnection between the battery and the rheophores. Please follow my movements carefully, and note the effect produced upon the muscle, according as I *make* the *negative* current or *break* it; the first is called *kathodic closure*, and is represented by the letters KC; the second is called *kathodic opening*, and is represented by the letters KO. Now I know perfectly well that this deltoid muscle will contract, for whenever I *make* the circuit, which I now do, the contraction of the muscle follows. This is called kathodic *closure* contraction (KCC). I now *break* this negative current, and observe the muscle; there is a slight contraction, but it is very slight compared to the *make*. This contraction is known as the kathodic *opening* contraction (KOC). So far, then, we have been dealing with the active negative or kathodic current. I will reverse the current and make it *positive* or *anodic* instead of *negative* or *kathodic*. Now, if you please, I will make and break this current as I did the negative current. Watch the muscle whilst I *make* sharply the anodic current; you see contraction follows, but not such a decided contraction as followed the kathodic make, but far greater than the kathodic break. This is called the anodic make or anodic closure contraction, represented by the letters ACC. I now break or open the anodic or positive current, and the muscular contraction so produced is called the anodic opening contraction (AOC).

These points with regard to muscular contraction upon making or breaking the positive (anodic) or negative (kathodic) currents are exceedingly interesting, and they admit of many modifications which I cannot enter into now, but which I might say are due to the strength of the current employed, and to the power and nature of the resistance which it has to overcome (conduction and diffusion).

As a rule muscular contraction is increased every time the strength of the current necessary to obtain that contraction is increased. For instance, kathode closure contraction (KCC) will be strong when obtained with the strength of current necessary to excite an anodal closure contraction (ACC) or anodal opening contraction (AOC), and very strong when compared with that which is required to excite a kathodal opening contraction (KOC).

I must now, if you please, draw your attention to the unhealthy or wasted deltoid muscle (so far we have been dealing only with the healthy muscle). It really is a question if we have *any* healthy muscular or nerve fibre here to deal with, and from the absence of marked response to the faradic current at different points, the conclusion is that the nerve has undergone degeneration similar to the muscle itself. However, we can in a measure solve the problem.

Bear in mind that muscle and nerve when diseased lose their power of reacting to electrical stimuli in the same manner that normal tissues do, so that we cannot hope to get the same reaction in this wasted muscle, or even an approach to it, that we got in the healthy muscle; anything like tonic or tetanic contraction is completely out of the question. Let me tabulate the reactions of the healthy deltoid muscle to the galvanic current, so as to make the matter clear to you:

$$1,\ \mathrm{KCC};\quad 2,\ \left\{\begin{array}{l}\mathrm{ACC};\\ \mathrm{AOC};\end{array}\right.\quad 3,\ \mathrm{KOC}.$$

Now, if you please, let us see what the reaction to the galvanic current of this muscle is. Our mode of operation shall be precisely as before, but instead of using eight milliampère current strength we will use fifteen, because I feel sure that the stage of irritability has passed.

I now place the kathode upon the muscle. You see there is no immediate response upon making closure, but after waiting some ten or fifteen seconds, you may perceive four or five rapid feeble contractions. I now reverse the current, from kathode to anode, making closure as before, and you see pretty well the same result; after a pause there are four or five feeble contractions, and the contractions to the breaking currents, both kathodic and anodic, are very doubtful.

Let us tabulate them, and compare the table with the former one:

$$1,\ \left\{\begin{array}{l}\text{KCC, reaction}\\ \text{ACC, after a pause;}\end{array}\right.\ 2,\ \text{AOC; } 3,\ \text{KOC, scarcely appreciable.}$$

Here we have, then, a good example of what is called the *reaction of degeneration.* Faradic excitability very greatly diminished, and galvanic excitability below normal. The prognosis is not particularly hopeful, or was not before the days of scientific massage; we will wait for a week, have the muscle massaged well daily, and again test the reaction to both currents. I shall call your attention to a somewhat similar case to this and to others which have come under my treatment during the past two years, and which have been treated by massage and galvanism.

Let me tell you at once, if you please, that massage is endowed with wonderful power, not only in arresting muscular, atrophic and nerve degenerative changes, but it possesses an ability unique *which no other agent does possess*, in restoring the nutrition and regenerating the growth of nerve and muscular fibre; and when I tell you that cases of progressive muscular atrophy which have been given up as hopeless have been cured by massage, under my own daily observation, I am quite sure you will agree with me that it should receive a definite place as a therapeutic agent of the utmost value.

I should like to say a few words to you relative to the pathological changes in this nerve and muscle which we have just been testing electrically, and I do so with the more interest because I feel certain that there is a stage in these degenerative changes of nerve and muscle which, if fully recognised and treated by massage, would completely revolutionize prevailing views concerning the more or less incurability of these conditions.

We conclude that the circumflex nerve supplying the deltoid muscle, which springs from the posterior cord of the brachial plexus, that is from the sixth and seventh cervical roots, has undergone degeneration in consequence of its nutrition being impaired, owing to atrophic change in the motor cell or corpuscle of the anterior horn of the grey matter of the spinal cord, from which it takes its origin and receives its motor stimuli; and we also have every reason to believe that the degeneration and wasting of the muscular fibres are due to defect in the nutritional or trophic nerve fibres which accompany the motor fibres of the nerve. Thus the degeneration in the nerve is called "secondary." The inflammatory action which originated in the grey matter of the spinal cord may be rapidly transmitted throughout the whole of the nerve to its intra-muscular nerve endings, and even to the fibrillæ of the muscle; the changes which occur in the nerve are an overgrowth in its cellular elements, its nuclei and protoplasm, whereby the nerve becomes segmented, and its conducting power either partially or completely destroyed. It ceases to be excitable, either totally or in part; in fact its function is gone, and it does not respond, as we have seen, to the faradic current; but according to the degree of loss of function so is its response to the continuous galvanic current. When the nerve fibres are in an active process of degeneration the nerve is in a state of irritative over-sensibility, and it responds to a weaker current even than it does in health, but the contractions are of the most clonic kind and soon cease altogether. Now, if, as I have told you, the trophic or nutritive nerves going to the muscles follow the course and are in association with the motor nerve fibres, it is evident that degeneration in the nerves must be followed by degeneration and change in the nutrition of the muscles. This is the case. The first change is functional atrophy, the second is molecular atrophy. The fibres become granular, reduced in width, and lose to a certain extent their striated outline, whilst the connective tissue is so increased that a condition allied to cirrhosis results. I am anxious just merely to touch upon this subject of change in nerve and muscle (degeneration) because what I want particularly to point out to you is this, that disintegration of a nerve and muscle may go on either rapidly or slowly to a considerable extent, and yet by massage, *and I maintain by massage alone,* regeneration can be effectually established. According to Ranvier regeneration is brought about by the growth of new axis cylinders from the central end of the nerve which become finally covered with myelin. If the nerve cannot be restored it is contrary to reason to hope that the muscle can be repaired. Our first knowledge of recovery of the nerve will be some increase in size and movement in the muscle, then, following this, we shall have a degree of response to the faradic current and to the kathodal closure of the continuous current. You may think that I have, perhaps, gone beyond my bounds in bringing this subject before you, but I have given you a glance at one form of muscular atrophy from organic disease, because there are degenerative and regenerative changes in association with it having clinical features of special interest; and I cannot leave the subject of *muscular atrophy* without again calling attention to other forms which concern us more particularly from the massage point of view. Of late years many forms of *paralysis of muscle* have been shown to be due to degenerative and inflammatory changes in the nerves and in their peripheral endings, without any corresponding change in the spinal cord, and it is well that these should receive some consideration from us, because it is this class of muscular atrophy which of all others is the most likely to be cured by massage manipulation, and even if we feel sure that we cannot *cure* these conditions, it is by no means certain that we cannot arrest their downward course by massage. Therefore, if you please, I will take these forms of paralysis and muscular atrophy in the following order—

Paralysis {
Muscular Atrophy, chronic.
Muscular ,, idiopathic.
Muscular ,, pseudo-hypertrophic (?)
Muscular ,, from disease.
Muscular ,, from over-use.
Muscular ,, from joint affections.
Muscular ,, from multiple neuritis.

“Alcoholic,” “lead,” “diphtheritic,” “diabetic,” and “hysterical paralysis.”

My remarks concerning these various conditions must necessarily be very brief, and I would rather merely name them to you than give you, as I am compelled to do, a very imperfect description of them, did they not present signs of different interpretation. In all kinds of muscular atrophy, no matter whether of central, peripheral or intrinsic origin, defect of nutrition is frequently a primary and important factor; and although we are unable to treat in a direct manner an inflammatory change in a nerve centre, yet, seeing that the periphery of a nerve is the direct continuation of that centre, we are fairly and reasonably permitted to arrive at the conclusion that we can indirectly influence that centre, with regard to its blood and nutritional supply, through its periphery, by those manipulation and galvanic processes with which we are now familiar. Nine tenths of the spinal diseases with which we are acquainted have a peripheral origin. A blast of cold air over a given area of skin will, in one case, inhibit the vaso-constrictors and produce dilatation of vessels as in erysipelas; but, in another case, the impress upon the skin is not necessarily potential, it travels along the nerve to its centre, and produces the same effect in that centre which it otherwise produced in the skin. This is a subject of great interest, and one concerning which I could say a great deal, but I must without further remark bring the muscular paralysis under your notice.

First, with regard to *chronic muscular atrophy*, let me tell you at once that this disease when fairly established has been looked upon as incurable; it is called *progressive* because its onward march, though slow, leads to a serious and in fact fatal issue. You may as well massage and galvanize a bone deprived of its periosteum as massage and galvanize a patient with progressive muscular atrophy after the disease has arrived at a certain stage. But it never should arrive at this stage; loss of function and of power to perform certain definite movements are the first indications which we have of this fearful and intractable malady. Massage and a very weak continuous current and passive automatic exercise at this period will check its onward progress and arrest its fatal issue. It may originate in the bulbo-spinal system, in the pyramidal tracts, or in the cord alone at any level, or it may originate in the lower cells of the kinæsthetic area of the cerebral cortex, the fibres from which take a definite course through the internal capsule to the pyramidal tract, and thence to the antero-lateral columns of the cord, giving rise to amyo-trophic sclerosis. This latter form of muscular atrophy is more common in women, the former is more common in men. Hysteria, as you know, is much more frequent in women than in men, and I wish you to remember that you may have signs simulating lateral sclerosis in hysteria which are really due to some functional derangement in the cells of the lower level of the cortical area of the brain.

The form of protopathic muscular atrophy which we are now considering generally commences in the arms or in the shoulder, or it may be in the muscles of the hand, particularly in the muscles of the eminence of the thumb. (The photograph I now show you is that of a young girl aged fourteen, a hospital patient. You can see almost complete atrophy of the muscles of the ball of the thumb; she was under galvanic treatment at several hospitals, and galvanism alone did not arrest the disease. I have not seen her for some time, but when she left, after three months' treatment by massage and static electricity, a very marked improvement had taken place, so, if not cured, I think we might say that the onward progress of the disease has been arrested by massage when other means had failed). Depressions are soon seen between the metacarpal bones on the back of the hand, and then the flexors of the arm become involved, the flexors usually before the extensors; and I may say that this is almost peculiar to this form of paralysis, for, as a rule, the extensors of the forearm give way before the flexors. I need scarcely tell you how the various muscles follow suit, or how parts become distorted, owing to the paralysis of certain groups of muscles over other groups, but I must just refer you to the sensory symptoms which are insignificant when compared to the motorial derangements, though these, such as they are, often give the patient a great sense of distress. I remember a man some years ago at the Central London Sick Asylum with almost complete atrophy of the muscles of the upper extremities and the shoulders, who complained sadly of aching, wearisome, rheumatic-sort of pains in these members and in the spine, where rubbings always relieved him immensely. I regret to say that I knew nothing of massage in those days as I know it now, and I can well remember going round the wards at that time with my hypodermic solution of strychnine and my galvanic battery, but, alas! I could neither cure nor relieve these unfortunate sufferers. Had I then known how to practise massage with and without galvanism as I do now, I am quite sure, and I speak with all sincerity, the case would have been very different.

I am not going to take up your time with any remarks concerning idiopathic muscular atrophy, suffice it to say that it is a rare affection, unassociated with disease of the spine, that it frequently begins by wasting of the muscles of one side of the face, never of the ball of the thumb, hand or forearm. The flexors of the arm and of the leg are always weakened and atrophied before the extensors;

whilst the glutei stand out with remarkable prominence, firm and hard. I have a gentleman patient, aged twenty-five, suffering from this peculiar affection; he has consulted the leading members of the medical profession, not only in this country, but upon the continent; hitherto the disease has been steadily advancing, but he has promised to place himself under my care for massage treatment, so I hope we shall have an opportunity of testing its merits.

The next form of muscular paralysis is what is called *pseudo-hypertrophic*. It is congenital in its origin and nature and is consequently associated with childhood; I have, however, seen several cases in early manhood. It rarely affects girls; I have had nine cases under my care, all boys. The condition when once seen and observed can never be mistaken; if you have any doubt about the diagnosis, lay the child upon his back and tell him to rise. The calves and the buttocks are remarkably hard and firm. As the disease advances so the muscles atrophy, and all kinds of deformity are the result. Dr. Gowers, in his work on the spinal cord and nerves, has given an original, complete and diagrammatic account of this affection to which I must refer you. Up to the present I regret that I have not (since my massage experience) had any of these cases that I could put well under treatment, but I am very anxious to have some, for I believe massage manipulations are likely to be effective, provided they are adopted early enough in the course of the disease.

Let me now call your attention to muscles *wasted* and *atonic* from disuse. This condition is one of atrophy, but it differs very materially from those forms of atrophy which we have just merely referred to, because there is really no organic change in the muscles or in the nerves; still the muscles are weak and almost powerless from defective nutrition, and in these cases massage will soon restore them to their normal state. Your services will often be required to effect this object. After a fractured limb has been incarcerated in splints or plaster of Paris for a month or six weeks you will find it (in some people more than in others) wasted and withered. Take for instance a case of Colle's fracture of the forearm, where it has been necessary to adjust a pistol splint with some exactness and care for a given period of time to prevent deformity arising, the joints are dry, the skin is shrivelled, the muscles are flabby, and the extremity is stiff, the circulation has been impeded, the digital and wrist movements are almost impossible, and when attempted are accompanied with great pain. The surgeon has done his work, the bone is united, but the part is practically useless. You have here an excellent opportunity of restoring the limb to its healthy condition in as many days as it would otherwise take weeks if left alone. Again, the orthopædic surgeon will often require your services. It is the practice after the division of tendons to adjust some form of steel apparatus to keep the foot in position. The muscles after the tendons are divided have a special tendency to waste more than they had before the operation. Now massage is imperatively demanded in such cases as these; I have often told you that I should give these patients a great deal more massage and much less steel. There is such a condition as muscular atrophy from *over-use*, but this is not common. It is probably caused by strain of an undue kind upon the nerve, and we know also that some athletes who are men of pluck rather than power, good for a spurt rather than for distance, are not unfrequently the subjects of muscular atrophy and general paralysis of the insane. Just as a man can break down mentally from mental over-work and utterly destroy a fine intellect, so in like manner can he break down physically from over physical work with resulting physical change in muscle and nerve.

I shall speak of muscular atrophy in association with *joint* affections when I am lecturing upon joints. (*See* Lecture XI).

I have an opportunity this morning to show you three forms of muscular paralysis of the forearms, each presenting different features, and all three are rapidly improving by massage and electricity. We will compare these three cases and consider the different signs and symptoms which each form presents to us. I will take the least complex first. This man, aged thirty-nine, is suffering from lead palsy. He is a painter, and you can see the lead line of a bluish black colour along the alveolar margin of the gums. Only the right hand and forearm are absolutely paralysed, but the grasp with the left hand is quite as feeble as with the right. The hand drops from the wrist, and he is unable to extend the fingers. There is no defect in sensation, neither is there any pain. Please remember these two points, for I wish my observations to be accurate, though they must of necessity be very brief.

This man, aged twenty-three, who had well marked secondary symmetrical atrophy of the upper extremities, is also a painter; but if you look at the gums you will find no trace of lead, and I really doubt if lead had anything to do with it. About four months before I saw him he began to suffer from muscular pains of the forearms and shoulders, what he called "rheumatic pains"; in a short time both arms became weak, and he was unable to raise them without difficulty, the hands then became weak, he could not lift a weight from the ground, neither could he co-ordinate the movements of the forefinger and thumb to write or to button his coat. The paralysis increased until the arms and the hands were almost useless. When I saw him on the 12th October, 1887, the muscular wasting of the arms was perfectly symmetrical; the deltoids were flattened and almost powerless, so that he raised the arms by jerking up the shoulders; when he attempted to grasp he did so by fixing the shoulders and throwing the heel of his hand into the part; the fingers were scarcely at all under his will; the muscles of the balls of the thumbs were greatly atrophied; when told to extend the hand it was only partially raised at the wrist; the terminal phalanx of the thumb was flexed, the proximal phalanx was drawn outwards; the forefinger and the little finger were partially extended, but the two middle fingers were flexed and powerless (this pseudo claw-like hand is characteristic); the muscles of the forearm were wasted; he had been galvanised by the family medical man, but the arms became more powerless. We commenced in October to treat the muscles by massage and galvanism, and from that time I may say the disease was arrested. At the present time he is all but cured. The atrophied muscles are now well developed, in fact every single and combined muscular movement is almost completely under his will, and he is following the occupation of a clerk. Who can doubt the influence of massage in restoring muscular power after such an instance as this? It is, however, only one of a number of which I have records.

You see this man as he is now with power restored him, but had you seen him (which I wish you had) when I first did so the contrast would have been implanted upon your memories for life. He is a sharp, bright, intellectual fellow, and felt duly and thankfully the influence which the treatment was having upon him, the more especially as he had been told that there was little chance of his recovery.

It was very interesting and almost amusing to see the delight with which he hailed the advent of some movement which massage had called back into existence. He would say "Look, sir, I could not do that a week ago, it would have been impossible!" The movements of single muscles were the first to return, the circumflex nerves (after the median) gave evidence of return to normal activity by the restoration of the deltoid muscles, then followed the flexors of the wrist, and after these the extensors. The last to regain their normal power were the muscles of the thumb, the thenar muscles in particular. The reaction of degeneration test was marked so far as all the nerves of the brachial flexors were concerned, but particularly the nerves of the posterior cord (circumflex and musculo-spiral); the branches of this nerve were the first involved and the last to get well. It was a great day for him when he could button his waistcoat and hold a pen. In this case, as in the other, there was no loss of sensation and no severe pain.

I now show you another case (the patient is a female, aged twenty-seven), where the objective signs are very similar to the last, but the subjective symptoms are very different and distinctive. It is a case of "multiple neuritis." You observe in the two former cases there was no defect of *sensation* and no *pain*, the motor area of the nerves being alone involved. Here we have an inflammation of the trunks and peripheral ends of the spinal nerves involving both their functions of sensation as well as motion, so that we not only find motion interfered with but sensation also. This woman, about six months ago, awoke in the morning with numbness, tingling, and burning pains in the fingers and hands; these were soon followed by defective power, so that when she was sweeping the floor the brush would, as she called it, fly out of her hands; the left hand was affected a week or so before the right; toward the after part of the day, and especially when the hands get warm, she has fairly good use in them. She will tell you that she suffers very much from cramps, with burning pains in the muscles of the calves of the legs and the toes; these come on particularly at night and in the early morning. Sometimes her feet feel as though they were on fire, although to the touch they are very cold. We have here, then, a case of symmetrical multiple neuritis, and the chief signs are defect of power in the arms and in those muscles supplied by the musculo-spiral nerve; defect of the anterior muscles of the legs, only slight compared to the defect in the arms; inability to extend the wrist and the fingers; some wasting of thenar muscles and extensor muscles of the forearms, accompanied with loss of sensation, more marked upon the extensor surfaces of both arms, hands, and legs and feet; there is also great pain experienced when too great pressure is made along the course of the nerves, as well as subjective pains to which I have referred; and if you look at the face you will observe that the mouth is slightly elongated, giving the countenance a smiling aspect. I have no doubt that both facial nerves are symmetrically affected here, though this, by the way, is not common. She has now been under massage and electric treatment for more than two months, the painful sensations and cramps have disappeared, the nerves when pressed upon are scarcely at all tender, and muscular movement has decidedly improved. Therefore, let me advise you once more of the fact, that for multiple neuritis you have an excellent remedy in massage and galvanism.

I had an exceedingly interesting case, which upon more than one occasion rapidly yielded to treatment by massage and galvanism. I find that I have headed it in my notebook, *Diabetes, Neuritis of Arms, Dystrophy of Muscle and*

Skin, Neuralgia. The subject was an elderly lady, sixty-four years of age, with pronounced diabetes and fondness for alcoholic drinks, who consulted me for this and for want of power, and general weakness in the arms. She remarked, *I have no thirst when at rest, but the slightest movement brings on a feeling of exhaustion and intense thirst.* At times she would have feverish attacks and become utterly prostrate with all her diabetic symptoms more pronounced. All the nerves of the arms and forearms—the musculo-spiral more particularly—to their periphery would become exceedingly tender upon pressure, accompanied with shooting pains; and in the course of a fortnight the palms of the hands would peel like a person recovering from scarlet fever, the dorsal surfaces of the hands become brown, and finally the skin would have the appearance of white parchment. As the feverish attack passed off in the course of a few weeks, nutrition reasserted itself, and the skin resumed its natural aspect.

There was marked tenderness along the course of the spine, and subjective symptoms too numerous to mention. Massage not only restored power to her muscles, but promoted nutrition generally, and decreased the amount of sugar in the urine.

I have now to call your attention to a form of paralysis where massage and galvanism is pre-eminently the essential mode of treatment. I shall deal with hysteria in a future lecture, so that at the present time I refer only to those functional and inhibitory processes of the nervous centres resulting in defective will power over voluntary muscular action and voluntary control.

This is an extremely wide, interesting, and important subject, and one, by the way, which is ill understood by many. It is unfortunately too true that many cases of hysterical sensory and motor derangements in the muscular system have been looked upon as due to organic disease, and what is still more serious, organic changes have been considered as due to hysteria; and this is in a measure excusable, because organic changes in the nervous system may be masked by hysterical manifestations. I have even seen cases of right hemiplegia in men, with complete aphasia, where emotion was most profound, and directly they were spoken to they would laugh or cry much as a highly hysterical woman would do. Therefore we have to guard against what may be an error of diagnosis; for in the one case our massage and electric treatment is curative, in the other case it is absolutely useless. I must, however, deal briefly with this subject, for to treat it exhaustively would take me completely away from the true object of my remarks. A common form of hysterical paralysis is that which often occurs in young women, "Hysterical loss of phonation." They can only speak in a whisper, although it may be they can sing well. They try very hard to speak, but the effort of will meets with no response. Faradization to the palate and vocal cords and massage (laryngeal gymnastics) is an infallible cure.

Hysterical or functional paralysis of the limbs may take the form of hemiplegia and paraplegia, the latter is much the more frequent. I need scarcely say that this affection is much more common in women than in men. That men suffer from hysterical paralysis is an undisputed fact. Hysterical hemiplegia is usually of the left side, and frequently in hysterical paraplegia it is more pronounced in the left leg than it is in the right. The onset of loss of power is generally sudden, usually from shock, which disturbs function and arrests nutrition, contractions and tremors are common, ataxy is often associated, the reflexes are normal or slightly exaggerated, usually the latter, and there may be retention of the urine. Electric irritability is normal. Gowers says, "So constantly is this true, that the nature of the rare cases in which a marked change in electric irritability has been found is open to grave doubt. As a rule there is no clonus. This is characteristic of hysteria. When there is a true characteristic clonus it is probable that there is a considerable alteration in the nutrition of the motor elements, although this may have arisen from a primary functional disturbance." Spasms, tremblings, and tremors, tonic and clonic, are common to hysterical paralysis.

M. Charcot, who has had unrivalled opportunities for studying these nervous states, applies the term "contracture" to that condition in which the muscles become rigid in tonic spasm, fixing a limb or limbs in a certain posture for a few minutes or for a much longer time. The contracture may, without leaving any trace of its existence, disappear in a few days, a few weeks, or even a year or more after its appearance.

M. Charcot remarks (1,) "That in hysterical hemiplegia there is an absence of facial paralysis and of deviation of the tongue when that organ is protruded.

(2,) The existence of an analgesia and of an anæsthesia, which may be termed absolute, extending over the entire paralyzed half of the body, and consequently occupying the face, trunk, etc. This alteration of sensibility involves not only the skin, but also the muscles and perhaps the bone—it stops exactly at the median line.

This kind of generalized anæsthesia, occupying a complete half of the body—head, trunk, and members, this quasi-geometrical limitation of the anæsthetic portion by a vertical plane, dividing the body into two equal parts, are as it were the peculiar property of hysteria."

Hysterical paraplegia, with contracture (*Fig.* 21) and deformity of the feet, resembling that of talipes equino-varus, claims passing notice. The contracture often succeeds an hysterical fit; it persists during ordinary sleep, and is only relaxed by the deepest chloroform narcosis. When contracture takes place in the upper limbs the arm is fixed in flexion. When it occurs in the lower limbs the legs are extended (*Fig.* 32). Sometimes extension is so marked that the dorsum of the foot is in a line with the front of the leg, the flexor spasm of the foot which occasionally accompanies organic disease is rarely met with in hysteria. Charcot relates several cases in which severe rigidity of very long duration was removed by strong emotion, and Gowers says that sometimes the effect of faradization is instantaneous. "One patient was thus cured in a moment, but months later relapsed, and then all treatment failed until she fell into the hands of a 'miracle worker,' at whose touch the spasm vanished amidst the plaudits of a public audience."

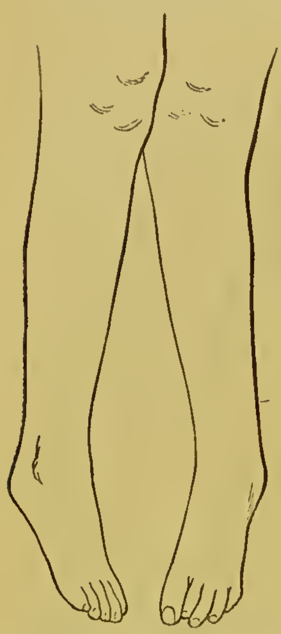

Fig. 21. Hysterical contracture of inferior extremities.

Dr. Laycock, in his treatise "On the Nervous Diseases of Women," remarks that a woman may have been bedridden for several months and quite unable to use her lower extremities, the physician may have given up all hope of being of any assistance to her, when suddenly under the influence of some potent moral cause she will be seen to rise from her bed, "no longer the victim of nerves, but the vanquisher," as Thomas Carlyle says, and walk about as well as if she had never been stricken with paraplegia. This is one of the terminations of hysterical paraplegia which the physician should never lose sight of, and which well shows what risk he runs in pronouncing a case of this kind to be incurable.

Tremor, clonic spasms of the lower limbs, with or without contracture, are frequent, and resemble the tremor accompanying disseminated sclerosis.

I need scarcely say that all forms of hysterical paralysis to which I have merely called your attention are particularly adapted to massage treatment; but this is a large and almost inexhaustible subject, so I must pass on now, if you please, to the consideration of neuralgias. And here again I must repeat that in these troublesome affections, massage, either with or without galvanism, is pre-eminently useful. I have spoken to you of neuralgias of the fifth and cervical nerves, so that now I shall confine your attention to some other forms of neuralgia which are extremely common, and which, by the way, are frequently very persistent and unyielding to drugs.

Neuralgia, as the name indicates, is a painful affection of a nerve. It may arise from a gradual alteration in the molecular nutrition of the axis cylinder, changing its excitability and conductivity. This is perhaps the most common cause, for neuralgia, as Romberg tritely expresses it, is the "prayer of the nerve for healthy blood," and the fact that neuralgic pains have a strange and constantly recurring periodicity is substantial evidence in favour of this statement.

Neuralgia may be due to a chronic inflammation (sub-acute) in the outer sheath of the nerve (perineuritis), in the connective tissue between the bundles (interstitial neuritis), or in the nerve fibres themselves (parenchymatous neuritis). Sub-acute inflammation is equivalent to vaso-motor disturbance, both conditions may lead to leucocytal infiltration of the textures, malnutrition, atrophy and degeneration; and although a nerve possesses the property of regeneration and repair in a marked degree, still its functional integrity for the exercise of prolonged strain after inflammatory change, is rarely, if ever restored to its normal primitive standard. We can scarcely believe that a nerve is diseased without the centre from which it arises being likewise involved.

Neuralgias are sometimes due to injury (traumatic), or from pressure, as they pass through bony foramina, or to morbid growths in their neighbourhood. It is unquestionable that neuralgias are associated with a "neurotic diathesis," and that they frequently originate from some cause which lowers the vitality, the metabolic processes and the normal blood status. I would put these causes before you as extrinsic and intrinsic; *extrinsic* in the form of malaria, exposure to cold, lead poisoning, prolonged fatigue, excessive anxiety, worry, mental strain, sewer gases, vitiated air, and sudden atmospheric changes: *intrinsic*, such as acid dyspepsia, diabetes, glycosuria, gout, rheumatism, and hereditary predisposition. Women are much more liable to neuralgias than men. But please remember, that just as there are types of individualities so there are types of neuralgias affecting certain centres of evolute nerve levels, from the cerebral cortex to the lowest spinal centre and nerve ganglion. To speak of neuralgias in reference to temperament is merely begging the question which it is impossible for me to discuss now; when I talk to you about pain, I hope to make my meaning clear to you. I must make you acquainted with the diffusion, the conduction, and the radiation of these neuralgic pains; and in massaging you will have to remember the rough anatomy and distribution of the ordinary nerves which are most commonly affected, I mean the fifth and cervical nerves, the brachial plexus and its branches, the intercostal, the lumbo-sacral, the sciatic and its branches, and the anterior crural. Of course, I need not remind you that the spinal cord is the source of these nerves, but I must ask you to remember this, that a localized neuralgia specially demands spinal as well as general localized massage. I am quite sure, after what I have told you of the anatomy and ganglionic distribution of the nervous system, you will comprehend how easy it is for us to have sympathetic or referred neuralgias. I explained this to you when dealing with the fifth nerve. There is no organ in the body which may not be the seat of a neuralgia in itself, or of experienced pain by sympathy. As instances I might quote cardiac, gastric, hepatic, ovarian, uterine, cystic and many other visceral neuralgias. You might know that in incipient hip-joint disease the pain is referred to the inner part of the knee. Gastric neuralgia might be referred to the head or to the heel; so that by massaging the periphery of a nerve you are influencing, not only the nerve itself, but also nerves which are in association with it by ganglionic connections, as well as stimulating cerebral and spinal reflex centres. If a reflex act be called into existence by some sensory impression, the efferent nerve conducts the energy which results from the sensory stimulus, but when the energy so generated meets with undue resistance in the centripetal nerve, the centre becomes surcharged and over-excited, and undue tension in the centre from confined energy is the result, which reacts upon the sensory fibres and gives rise to pain, so that the nerve centre is in fact the seat of the pain which may be experienced along the course of the nerve and its periphery, or on either singly. A neuralgic condition of a nerve may give rise upon pressure on some part of its course to painful spots, and by these painful spots we can trace the nerve to its origin in the spinal cord, and tenderness of the vertebral spine corresponding to the origin of the painful nerve can frequently be elicited. I must without further remarks at once direct your attention to the special neuralgias which we must consider in this lecture, and the special kinds of massage necessary for their cure.

Cervico-brachial Neuralgia corresponds to the distribution of the brachial plexus of nerves which arise from the cervico-dorsal portion of the spinal cord. The parts usually affected are the shoulder, the arm, the forearm, and the region bordering the spinous processes of the four lower cervical and two upper dorsal vertebræ. When painful spots exist they are usually found on the shoulder and supra-scapular fossa and the lower angle of the scapula, also in the axilla, the flexure of the elbow and inner condyle, and at the points of exit of the branches of the musculo-cutaneous nerve and of the ulnar nerve, along the course of the radial nerve, as well as at the wrist joint. A common focus for pain is four or five inches above the outer condyle, over the musculo-spiral nerve. It may radiate to the chest and pectoral muscles, and simulate angina pectoris. This is one of the most common forms of neuralgia; it is paroxysmal, and interferes with the movement of the arm, because any extension or backward movement starts the pain. It may exist with rheumatism of the shoulder joint, but not unfrequently this joint becomes stiffened more from disuse than from any other cause, and if such be the case, all adhesions in the joint must be broken down before massage is commenced; therefore, if you please, see that the movements of the shoulder are free,—rotation, abduction, adduction, elevation and backward movement.

Having made yourself sure that the shoulder-joint is free, you massage the extremity in the ordinary way, by effleurage and petrissage manipulations, and passive movement of every joint; you then pick out the seats of pain, and you petrissage them carefully, increasing your pressure until the pain is gone; this process to the patient may be productive of some discomfort. You will find a mixture of equal parts of chloroform and castor oil an exceedingly good lubricant; it has the effect of deadening the acuteness of peripheral pain, and it will also allow you to make your movements with greater freedom. In this, as in all other forms of neuralgia, do not be rough or cruel to your patient by forcible efforts, for I do not believe that you gain anything by it. It is of course impossible to avoid giving your patient some pain, but mitigate it as much as you can. If the arm is so painful that the necessary manipulations cannot be borne, my practice is to inject a half-grain of morphia into the deltoid muscle before operating, and in the course of half an hour movements can be effected which could not previously be tolerated. In all neuralgias it is best, as far as you can do so, to put every muscle into a state of absolute contraction and extension. For the first three or four days do not let your patient make any voluntary movement of the affected limb, but as the arm becomes less painful, graduate volitional movement day by day of all muscles until the normal action is restored. Then strengthen the limb by labile faradization (very weak). Never use the faradic current until the pain is decidedly diminishing; but you may from the first use the galvanic continuous stabile current, placing the kathode upon the inner side of the arm, and letting the patient hold the anode in the hand of the same side. The current must not be strong (five to seven milliampère), neither must it be interrupted.

Neuralgias of the trunk of the body are specially referable to the dorso-intercostal and to the lumbo-abdominal nerves. I must draw your particular notice to intercostal neuralgia, and especially to that form which frequently affects elderly people, it is sometimes associated with shingles and sometimes with glycosuria. During the past twelve months I have seen seven cases of this form of neuralgia where nothing but twenty grain doses of antipyrin with three grains of quinine relieved the pain, and then only for a very short time.

In one particular case where other drugs had been administered by one of our most skilful physicians, all failed to give any but the most temporary relief. In the case referred to the old lady would at times become distracted with the apparent agony of the pain, which came on with great severity in the evening. You must draw the distinction between intercostal neuralgia and pleurodynia; the latter is localized, and does not, like the former, take the course or exit of the intercostal nerves. Intercostal neuralgia is not often bilateral, it is usually confined to one side, and to those nerves running along the intercostal spaces from the second to the tenth. If pressure be made over the spinous processes of the vertebræ corresponding to these nerves, great pain is frequently experienced: the pain is generally very acute, burning, scalding, stabbing, are terms frequently applied to it; the patient's rest is disturbed night after night, so that every function is deranged by the continuous administration of narcotics and sedatives.

I know of but one remedy for this form of neuralgia, and that is massage and the continuous galvanic current; but both require special application, local and spinal; I have seen both fail because they were improperly and injudiciously applied. Then, if you please, do not faradize; if you do the effect will be unsatisfactory: I speak from experience. The first thing to be done is to localize the nerves which are the seats of pain, from the vertebral spine to the periphery. Galvanize first and massage after, in the following manner. Get two flexible flat electrodes, the one narrow and about four inches in length, the other about six inches by three; let them be well moistened with hot water and a very small quantity of dilute acetic acid: make the former the kathode, and the latter the anode; the positive electrode must be placed upon the ribs and the negative electrode to the mid-dorsal region of the spine; bind them to the body by means of a soft flannel bandage. Now make your connections, having the galvanometer in circuit, and never use more than two milliampère current strength. This must be kept up for half an hour: alternate current and continue for another half hour, then remove the electrodes, wipe the parts dry, and massage between the ribs from the vertebra towards the sternum; each intercostal space must receive the most careful attention; every particle of skin should be picked up and petrissaged with extreme care between the tips of the finger and thumb, and then the intercostal spaces should be pressed very patiently and firmly; and, lastly, rub briskly into the parts the mixture of castor oil and chloroform. This treatment must |be continued daily until the pain has ceased. It is usually mitigated after the first operation.

Lumbo-abdominal neuralgia is of course usually found in the lumbar region; sometimes it extends around the abdomen. It varies from lumbago and the backache of women by its foci of pain and tender points which are situated by the vertebræ at the back along the iliac crest and at the lower border of the rectus muscle. The usual treatment for these forms of back pain is the same in all three cases. The continuous current, of about five milliampère strength, should be applied to the loins by means of a large sponge electrode (kathode), such as I now show you, whilst the anode is applied to the hypogastric region. Let the current be maintained for half an hour, then reverse the current and continue it for ten minutes; after this petrissage and tapote the muscles thoroughly. This form of neuralgia might be "referred," its cause being some abdominal growth or reflex of the uterus.

Sciatica and Crural Neuralgia.—These two neuralgias of the buttock, thigh, and leg are of great interest to us from the massage point of view. Let us take sciatica first. The sciatic nerve is as you know the largest nervous cord in the body, and supplies nearly the whole of the integument of the leg, the muscles of the back of the thigh, and those of the leg and foot, it also supplies the hip joint.

The crural nerve supplies the muscles on the front of the thigh, sends cutaneous filaments to the front and inner side of the thigh and to the leg and foot and articular branches to the knee. The treatment of these forms of neuralgia is so similar that it may be considered both at the same time.

I quite agree with Dr. Gowers who states that the vast majority of cases of sciatica are really cases of neuritis of the sciatic nerve, yet I have seen a number of cases which are essentially neurosal rather than neuritic. Unquestionably gout and rheumatism are common factors of this condition, and just as we find a brachial neuralgia associated with a rheumatic condition of the shoulder joint, so do we see cases of sciatica associated with gouty and rheumatic changes in the hip joint. Its exciting cause is exposure to cold and damp, sitting in wet seats, such as one frequently finds in hansom cabs, or on wet grass, and damp ground.

It generally commences with slight pain along the back of the thigh, which is sometimes accompanied with tingling and formication. The whole course of the nerve may be acutely tender upon pressure, the pain is invariably increased by movement. When we take into consideration the wide distribution of this nerve, we can easily understand the reason why pain is often experienced at different parts of the leg, notably near the iliac spine, the sciatic notch, the lower third of the thigh, the back of the knee, the head of the fibula, the outer malleolus and the back of the foot, &c. The onset of this affection is often attended with fever, general malaise, and sleepless nights. When the disease is persistent for months, and particularly if the hip joint grows stiff, the muscles become flabby, weak and wasted, and when such change takes place it seems to affect all the muscles, buttock, back of thigh and calf of the leg. In these cases the nerve has undergone some degeneration, and is altered in its electrical reaction. I have seen several such, and cure is almost out of the question. But we have to consider ordinary cases.

Crural Neuralgia is an affection of the nerves of the front of the thigh, leg and foot. I have not seen many cases of this, but I happen to have one under my care at the present time. He is a gentleman about thirty-nine years of age, who, after getting wet and standing about in his damp clothes, first experienced pain which was not very severe and which he thought was rheumatism in the left hip joint. After this he had what he called wandering pains in both testicles, and then followed very severe and excruciating pains in the right inguinal region, extending to the testicles and right hip. It then spread to the anterior and inner part of the thigh (he said the upper part of the thigh seemed to him as though it were bound by a cord), and to the anterior part of the leg and foot down to the instep. All the front of the leg was extremely tender to the touch. He was confined to his bed for nearly a month, and no form of medicine did him any good until, at my suggestion, he took twenty grain doses of antipyrin with three grains of quinine three times a day in milk. He subsequently came under my care for massage.

Now there are one or two points of value to be considered in reference to the treatment of these cases. In the first instance (acute stage) I should advise antipyrin and quinine to be given so long as the acute symptoms last, and if the condition became persistent and chronic the sooner they were under our care for massage and galvanic treatment the better for them. No doubt many cases of chronic sciatica disappear in an almost miraculous manner by the injection of ether or the application of blisters, and so on; but a very large number get nothing more than *relief* from ordinary treatment. I have notes of many cases, which were ultimately *cured* by massage and electricity and extension movements only.

In cases of sciatica and neuralgia of the crural nerves the treatment is somewhat similar. I am not in agreement with the heroic treatment adopted by Schreiber, although I am quite willing to admit that after the inflammation (perineuritic) has subsided adhesions exist which demand active straining and stretching, and until these are broken down neither nerve nor muscle can perform its function aright. If there be no evidence of central disease, and the pain becomes chronic and cannot be relieved in any other way, I think it is quite justifiable to cut down upon the sciatic nerve and thoroughly stretch it, but there can be no doubt that stretching the nerve can be effected by forcibly flexing the thigh of the diseased side upon the abdomen of the opposite side in the manner I now show you (*Fig.* 15). And this, if necessary, should be thoroughly and effectually done whilst the patient is under chloroform, before massage manipulations are commenced. This operation sometimes relieves the nerve, and the patient feels better at once.

The limb must be massaged in the usual way and all joint movements thoroughly carried out after the manner I have shown you. I find it a good plan to flex the thigh upon the abdomen and use hacking movements over the nerve as it issues from the sacro-sciatic foramen. I prefer after massaging the limb in the customary way, from below upwards, to work at the nerve from above downwards, using careful and very complete pressure upon it as it descends between the trochanter major and tuberosity of the ischium. With regard to the application of electricity, so long as there is pain upon pressure along the course of the nerve, I never faradize, and remember, if you please, that I never apply the faradic current to the nerve if there is evidence of some nerve degeneration. I have seen two cases of this kind where there have been nerve degeneration and muscular wasting, when after a strong faradic current the function of the nerve has become lost, and irreparably lost; so I always use the continuous current, making my patient sit upon a large sponge electrode (kathode), and putting the leg of the affected limb in a salt and water bath (anode). The current should not be too strong, about twenty milliampère, and it should be continued for half an hour, reversing the current once only every ten minutes. This form of treatment should be continued for a week or ten days, and the patient during this time should walk with a crutch rather than use too much voluntary effort.

There are certain forms of muscular paralysis due to *fatigue*—some with and some without spasm—which are well designated "occupation neuroses," and amongst these we have telegraphists' cramp, seamstresses' cramp, pianoforte players' cramp, and the most important of all, writers' cramp. The last named form of cramp is met with more frequently than any of the former and is more difficult to cure, therefore we will give it special attention. It usually commences with a feeling of fatigue in those muscles which are called into play in the act of writing, and which control the movements of the thumb and two first fingers. Four forms of this cramp are recognized, namely, the spastic, tremulous, neuralgic and paralytic (Gowers.) As soon as fatigue has established itself tremors set in, rendering further muscular efforts useless. The muscles of the thumb are most affected. At the onset an aching sense of weariness extends up the arm which soon renders the sufferer unfit for writing. The pen does not move quite as he intends it to do, the strokes are made irregularly, they fall either too high or too low, and spasmodic movements create failure in definition. The first finger has a tendency to slip off the pen, and the more firmly the pen is held the greater seems to be the difficulty, until the pen is either dropped or jerked from between the fingers. Muscular fatigue, with aching, sickening and wearisome pain, may, for a long period, be the only indications of this troublesome complaint, but they will gradually increase in gravity and intensity, so that day by day the act of writing becomes more and more distressing and laborious and finally absolutely impossible. A subject of this disease who at one time could write fluently for twelve hours at a stretch is now unable to write his own name. It is interesting to note that this muscular weariness and inco-ordination seem in some cases to be limited to the act of writing; for other movements, such as playing the piano, or shaving, can be performed with perfect facility, and the grasp of the hand is only a little weaker than it is in health. The pain is very variable and may be referred to the joints of the fingers or to the fingers themselves, the thumb and the wrist, or it may extend up the arm to the armpit. The large nerves of the arm—and of course particularly the musculo-spiral—present signs of tenderness on pressure. Sensory symptoms are sometimes experienced, such as a feeling of tingling or pins and needles in the fingers, which appear to be quite independent of muscular derangement. This form of functional paralysis is generally found in members of both sexes who are of decidedly nervous temperament, anxious and over-worked, and who have by heredity some tendency to nervous disease. The act of writing or of copying, although volitional, should be performed almost automatically, and it does seem that in a large number of these cases there is not only too great a strain put upon the motor centres of the cord, but that when the associated centres of the cortex are in action at the same time in the processes of ideation the tendency to this condition of disease is greater than under other circumstances. Defective power in both nerves and muscles appears to be of a purely functional character; there may perhaps be slight wasting, but this is altogether exceptional, and, should it occur, we are led conclusively to the opinion that the writers' cramp has originated in a nervous system where centres are prone to become, under given conditions, the seat of degenerative changes.

We can scarcely admit that a localized fatigue can exist with a healthy tonus of the muscular and nervous systems as a whole. Many observers have endeavoured to elucidate this vital element of the question. Some of the latest consider the weakest link to be the peripheral apparatus, and the best researches at least support such an opinion. Dr. G. V. Poore, in his very interesting papers on "Writers' Cramp and Allied Affections," contributed to the Royal Medical and Chirurgical Transactions, has brought forward many facts connected with the living human body tending to support the hypothesis which locates the mischief in such cases in the peripheral apparatus. The experimental evidence adduced by Dr. Augustus Waller is confirmatory of such a view and is besides of a highly suggestive character. It is difficult to assign adequate reasons for the notion, but *a priori* we should expect that the points of junction of any apparatus would prove the weakest points thereof. And so it apparently is in the nervo-muscular apparatus. The weakness appears to exist neither in the nerve cell of the motor cortex, nor perhaps even in the motor cell of the spinal cord, nor further down in the muscle itself, but rather in the junction between the pyramidal fibres and the motor cell of the cord, and the similar place (the motor end plate) in the muscle.

Another important point to be decided before we can be fairly considered to have any real knowledge of the nature of fatigue, is the causation of the nutrition of the terminal organs —the actual conditions on which they depend for their existence as functional elements. All the information at present at our command would seem to show that the periphery is at the mercy of the centres, that the central motor cells can live and have their being without the aid of their terminal ramifications. Angello Mosso, of Turin, states that fatigue, carried beyond the moderate stage at which it is decidedly beneficial, subjects the blood to a decomposing process, through the infiltration into it of substances which act as poisons—substances which when injected into the circulation of healthy animals induce malaise and all the signs of excessive exhaustion.

That the chief cause of fatigue is the formation of certain products and their action on the tissues is not a self-evident proposition, because it seems to be clear that any tissue excited unduly in a given space of time must become exhausted; and it is equally possible that fatigue, as a sensation, may be caused by the negative condition of diminished reconstruction as by the positive one of actual irritation by the products of metabolism. The facts at present ascertained would seem to prove that the negative and positive states are both operative in the causation of fatigue.

Erb ("Lancet," July, 1887) states that writers' cramp (in typical cases) depends upon a disturbance of nutrition of the central nervous system, situated either in the cervical cord, in the peduncles, or in the cortex.

In the treatment of this affection most authorities are agreed that centralized rest of those muscles co-ordinated in the act of writing is absolutely necessary.

"Nussbaum," according to Schreiber, in an article published in 1882, "directs his patients to write as much as possible with the instrument figured and described below, which compels the wearer to use his muscles in a way diametrically opposite to that he has always practised. He says to his patients: 'Write much with this apparatus, for the more you write the sooner you will be cured, and be able to hold the pen in the common way again.'" The celebrated Munich surgeon is of opinion that over-exertion of the flexors and adductors—these being the muscles chiefly used—is the cause of the cramps, and that the condition may be cured by using the extensors and abductors instead. To this end he has constructed the apparatus shown in *Fig.* 22.

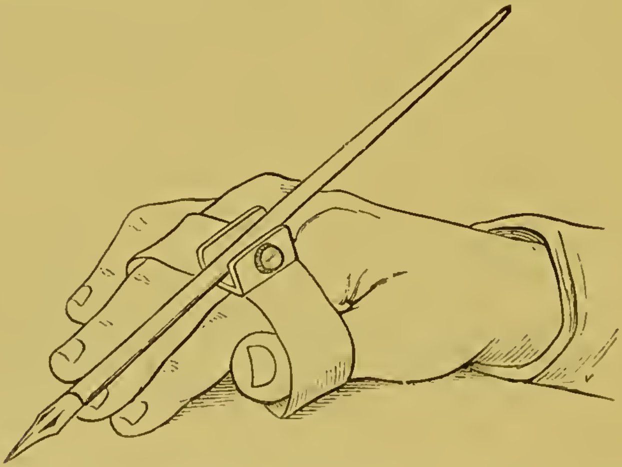

Fig. 22.—Nussbaum's appliance for writers' cramp.

It consists of a thin oval band of hard rubber, about two centimetres broad, suitably curved for slipping over the thumb and all the fingers except the little one, which remains outside. By means of a clamp a penholder can be conveniently adjusted. The long diameter of the oval being made purposely somewhat longer than the breadth occupied by the fingers over which it is to go, the fingers will have to be spread apart, the thumb being drawn to the left, the fingers to the right, to prevent it falling off. Muscles are thus forced into use which are the exact antagonizers of those normally used, and at the same time the act of writing is transferred from the fingers to the whole hand, and motor impulses formerly sent to the flexors and adductors are now delegated to the extensors and abductors.

Nussbaum thus gives the result of his experience:

"(1,) Every patient who formerly was unable to even scratch down his name, let alone write a couple of lines, could, to his great surprise, write two pages consecutively without fatigue with the apparatus.

(2,) No cramps ever occurred while using it.

(3,) All agreed when using it, that those parts of the hand which were formerly the most painful, felt now even more comfortable than normal.

(4,) After using the apparatus diligently for some time, a few patients felt intuitively that they were again able to use the pen in the old way.

(5,) In treating this disease, it simply stands to reason that the cramped muscles must be thrown out of use while their antagonizers must be strengthened by gymnastics."

During the past three years I have had several opportunities of using this ingenious and clever little apparatus, and my success has been simply complete when combined with massage and the continuous galvanic current in a manner which I will show and explain to you directly. But the doctor must be pains-taking and persevering, and the sufferer must be patient, compliant and reliant: I need scarcely say that these are attributes which patients do not always possess. Gowers says, "For this affection, treatment to be effective should be early." This remark applies to every form of disease. I have a patient under treatment at the present time who has learnt to write with considerable facility with the left hand, so that the right hand is not brought into use at all; this, as far as treatment is concerned, is a great advantage, and should be adopted if possible in every case. The loss of writing power is a source of great mental distress to some, especially to those whose livelihood depends upon it, and this becomes a conflicting element in the cure, and leads to physical weakness, and sometimes to general nervous prostration, disquietude, irritability, and sleeplessness. We must take every means in our power to arrest such a condition when it is present. I have found it expedient to make the patient wear an india-rubber band about two inches wide around the wrist, and this has been in my experience all that is necessary in the way of mechanical support. In all ordinary purposes the hand should be used in the normal manner.

The points to be attended to in treatment are: rest to the affected muscles, massage, the application of the continuous galvanic current, digital gymnastics, and the injection of strychnine into the upper and outer part of the forearm. I have no faith in strychnine when there is marked muscular wasting, but in functional paresis it is invaluable. The patient should exercise the muscles of the hand in writing, particularly the extensors and abductors by means of Nussbaum's apparatus three times a day for three minutes each time, and after doing so, the *entire* arm should be massaged precisely according to the manner directed in my second lecture, from the tip of each finger to the shoulder-joint; and this should be followed by massage of head, neck, and spine night and morning—the time occupied at each operation being twenty minutes. Every other day the continuous galvanic current should be used in association with an arm bath of hot salt and water for five minutes. The cathode (a flat electrode) should be placed high up at the back of the neck, the anode being placed in the water, a weak current of five milliampère strength is all that is necessary. The patient should be taught to exercise the fingers in marching order over the surface of a table for one or two minutes at a time, always beginning at the right hand lower corner by extending the thumb to its utmost limit. He commences in the way I now show you, and so marches onwards to the distant left-hand corner in a diagonal direction, always stopping immediately if it produces the least fatigue. This form of gymnastic movement should be varied in the following way: the hand and forearm must be laid flat upon the table on their extensor surfaces, and the thumb must be extended to its utmost limit and fixed in this position, whilst the terminal phalanges are flexed rhythmically and slowly towards the palm not more than half a dozen times. Now let me tell you that this is my mode of treating writers' cramp. In substance there is nothing original about it; in detail it differs from other recorded methods, and it is in the carrying out of details very minutely and carefully that we can hope to cure this very troublesome and distressing affection. You will have many opportunities of treating all forms of occupation neuroses, and let me warn you against doing too much; small and repeated doses of treatment will often prove of essential service when the reverse will frequently do more harm than good.

I have to say a word or two to you relative to massage of the limbs in disease of the central nervous system. Let us take, for example, the various forms of hemiplegia, some right, others left. In some the arm is most affected, in others the leg. In some there is rigid persistent contraction, in others the muscles are flaccid. The arms, rarely the legs, are sometimes the seat of burning, aching, wearisome pains. Right hemiplegia is sometimes associated with spasm of the hand and fingers (athetosis), the muscular sense of the paralyzed limb is also greatly interfered with. The question arises, Can we improve these paralyses, relieve pain, and help to restore power to the muscles, and co-ordinate movement by massage? Well, I can assure you that in some cases it is very useful, in others its influence is nil, and it does not require much knowledge of the physiology of the nervous system to tell us why it is not useful. But let me tell you this: If I neglected to advise massage and weak faradization to any patient who came to me suffering from hemiplegia, I should consider that I failed in my duty as a physician. It matters not one atom whether the brain lesion be cortical or basal, thrombotic or embolic, anæmic or hyperæmic, large or small, coarse or fine, gross or delicate, whenever there be a paralysis, limited or extensive, purely motor or sensory or motor only, massage should be used. For I maintain that although the paralysis may be due to an extensive lesion, still, by helping to maintain the nutrition of nerves and muscles by massage and passive movements, we aid the brain (if such be possible, that is if the lesion is not too profound) to compensatory effort, and to the restoration of function in structures adjacent to the lesion. There are some people who seem to think that massage has to do only with the parts to which it is applied, say for instance, a muscle; of course, this is a great mistake. The integrity of the muscle depends upon the integrity of the nerve, and the integrity of the nerve is dependent upon its nervous centre, and the integrity of the nervous centre is dependent upon both nerve and muscle.

Again, we cannot hope to cure a sclerosis of the brain or cord by massage, to think of it is utterly preposterous, but we can possibly arrest its spreading, and start compensatory processes; and we can relieve nutritional and functional nerve troubles (usually peripheral), which frequently give patients much more distress, pain, and discomfort than the disease itself. This is a very wide and interesting subject, and deserving of study from a great many points of view.

Lecture VI.

MASSAGE OF VENOUS AND LYMPH CIRCULATIONS.

The nature of these Circulations — Blood pressure influencing the Lymphatic Circulation—The Lymphatics as Absorbents—The connection between the Lymphatics and Lacteals — Peri-vascular Lymph Spaces — Massage for Varicose Veins, Heart Disease, and Myxœdema.

In studying the value, the nature, and the effect of the massage processes upon the human body, it does, at first sight, appear that their influence upon the circulation must be of greater importance then their influence upon the nervous system; but these two systems are so intimately correlated that it seems almost impossible to say that the one is positive or negative to the other. We know quite well that the circulation is governed and controlled by energy of nervous origin, but you might just as well expect to get a galvanic current from two elements without an exciting agent as energy from a nerve cell without the blood as an exciting agent. This dependency and intra-dependency, or subjection *versus* antagonism, between all vital processes are phenomena most intimately associated with vitality itself—life being the sum total of an infinite variety of factors. Irritant action is everywhere manifest in developing the energy of function. Antagonism is the agent for the development of energy. May not life be maintained and supported and energy created by an increasing warfare between functions? This is a doctrine with which the name of Sir Wm. Grove is notably associated, which was so ably exemplified in his address at the Royal Institute. Are not the processes of massage of this nature? The nutriment of one creature may mean the destruction of another.

All thinkers have had to note the existence of continual war throughout creation — death and life, good and evil, charity and malignity, are illustrations of it. Race has been observed battling with and trampling down race. The ravages of fire, the fury of the floods, the angry strife of wits, have been marked and deplored by numberless generations of moralists. By Darwin its virtue was perceived as well as its power. He traced its invincible and indispensable utility in compelling organized vitality to ascend through an infinity of stages from imperfection towards perfection. In its ordinary character it preserves the current of being in happy and healthy action, it secures the regular beating of the human pulse, as well as the pulse of the universe. The sense of tranquil comfort, when the physical functions perform their duties accurately and fully, arises from the balanced struggles of opposing forces, not from the unchallenged despotism of one. Antagonism is a law above and beyond gravitation. It holds the stars in their courses. It is that which gives the sensation novel its charm. It is the secret of the fascination of party controversies. Light, heat, and motion all illustrate its activity. Health exemplifies it at least as entirely as disease. Very possibly time may show that even the bacteria which Sir Wm. Grove's scientific benevolence does not prevent him from stigmatizing as "unwholesome," administer a necessary incentive to the lauded white corpuscles to keep them vigilant and alert. Sir Wm. Grove completes the chain by his claim for it of the rank of a law of nature, inorganic as well as organic, as active in life as in death, as potent for preserving as for transforming, as sensibly benignant as it is ultimately salutary. I would ask, how far cannot the physiologist carry these views of antagonism into the never-ceasing functions of life? We might fairly consider that there is a constant antagonism existing between the fluids circulating throughout the body varying with the laws of pressure, absorption, diffusion, endosmosis, conduction, and resistance, and every possible management has been made by nature; through the aid of compensatory powers and processes, to remedy these defects when they exist. When compensation is inadequate to cope with excessive pressure, effusion, exudation, and dropsies result.

It would be out of place for me to attempt to discuss the pathological changes which give rise to increase of blood pressure, to alteration of normal resistance, or inefficient compensation, other than in a very general manner. We have seen how nerve influence maintains the general *tonus* of the circulation. The veins absorb equally with the lymphatics under normal conditions; but when there is vaso-paralysis venous absorption must be at a standstill, and the juices of the tissues accumulate in the canals, peri-vascular lymph spaces, and lymphatic capillaries. By massage manipulations we exercise counter-pressure, and with marvellous results in many cases where natural compensation and resistance have been inadequate to overcome undue *blood pressure;* and, remember, the same law which applies to the circulation of a part applies equally to the body as a whole.

"All conditions which *diminish* the *difference* of pressure between the arterial and venous systems *increase* the *venous* pressure, and vice versa. General plethora of blood increases it, anæmia diminishes it.

Respiration affects specially the pressure in the veins near the heart; during inspiration, owing to the diminished tension, blood flows towards the chest, while during expiration it is retarded. The effects are greater the deeper the respiratory movements" (LANDOIS and STIRLING).

These laws of pressure, particularly in the capillary circulation, are of great interest to us in considering the more immediate effects of massage manipulations. The resistance to the blood-stream is greatest in the capillary area, and if the diameter of the veins be narrowed leading from the capillary area the intra-capillary blood pressure is increased. Changes in the position of the limbs alter the venous pressure; but if the muscles of the veins give way the normal resisting power of the wall of the vein is lessened, dilatation arises, and *varicose veins* result. When we pinch, knead, and compress a muscle, for instance, or when it is stimulated to contract by the electric current, or by natural means, the flow of blood towards the heart is greatly accelerated.

Dr. Graham, in a few suggestive sentences, puts these physiological facts concerning the circulation in such a practical form that I cannot do better than call your attention to them. "Exercise accelerates the action of the heart and diminishes blood pressure, which means an increase in the rapidity of the current, and in the quantity of the flow, through the relaxed, distended, or stretched blood vessels. Massage also diminishes blood pressure, but without increasing the activity of the heart; on the contrary, the heart's action is lessened in force and frequency. And on reflection this is what might be expected, for natural obstacles to the circulation are gravity and the friction of the blood against the walls of the vessels, and these working backwards towards the heart have to be overcome at each systole of the left ventricle. These hindrances are by massage, both directly and through the medium of the vaso-motor nerves, in great part removed. The contracting hands of the manipulator are as it were two more propelling hearts at the peripheral ends of the circulation co-operating with the one at the centre; and the analogy will not suffer if we bear in mind that the size of one's heart is about as large as their shut hand, and the number of intermittent squeezes of massage that act most favourably on vessels, muscles, and nerves, are about seventy-two per minute, which is about the ordinary pulse rate. If this is not an act that does mend nature, what is?" *

That massage movements have a very decided influence upon the lymphatics is beyond dispute, therefore it is important that I call your attention to these chyle and lymph carriers. If we compare the capillary blood system with the lymphatic system we shall find that the former may be regarded as our irrigation system which supplies the tissues with nutrient fluids, while the lymphatic system may be regarded as a *drainage apparatus* which conducts away the fluids that have transuded through the capillary walls. Some of the decomposition products of the tissues, proofs of their retrogressive metabolism, become mixed with the lymph stream, so that the lymphatics are at the same time absorbing vessels; substances injected under the skin are in part absorbed by the lymphatics.

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* Dr. Graham, Practical Treatise on Massage.

"A study of these conditions shows that the lymphatic system represents an *appendix to the blood vascular system*, and further that there can be no lymph system when the blood stream is completely arrested, it acts only as a part of the whole and with the whole" (LANDOIS and STIRLING).

Lymphatics originate in different ways. For instance, in the villus of the intestine (where, by the way, the lymphatic goes by the name of chyle vessel or lacteal, and has enormous absorptive power) they originate by apertures or stomata, much in the same way that they do in serous cavities, so that the serous cavities are said to belong to the lymphatic system, and fluids placed in serous cavities readily pass into the lymphatics. Again, some lymphatics originate in what are called perivascular spaces. The smallest blood vessels of bone, of the nervous system, and of the liver, are completely surrounded by wide lymphatic tubes, so that the blood vessels are completely bathed by a lymph stream. In our manipulations the lymphatics with which we have principally to deal are those which originate in the juice canals of the connective tissue, such as we find in the skin and lower epidermal cells and the fascia between muscles, with which the minutest lymph capillaries communicate. Physiologists tell us that blood vessels also communicate with these juice canals, and that fluid passes out of the thin walled capillaries into these spaces through their stomata. This fluid being the nutritive fluid, each tissue with which it comes into contact selects from it that which it requires, whilst the effete materials pass back into the spaces, and from these reach the lymphatics, which ultimately discharge them into the venous blood.

The leucocytes, or wandering cells, appear to have the power of absorbing colouring or foreign poisonous matter and carrying it to other parts of the body. The pigment particles used for tattooing the finger are usually found within the first lymphatic gland at the elbow. As far as I can understand, the true leucocyte is frequently a carrier of death in much the same way as the red blood cell is the carrier of oxygen or life by means of hæmoglobin, but I shall refer to this again when speaking of Mosengeil's experiments upon the lymph stream. It is interesting to us to note that all conditions which increase the pressure upon the juices of the tissues increase the amount of lymph. Paralysis of the vaso-motor nerves (LUDWIG) or stimulation of vaso-dilator fibres, by increasing the supply of blood, increases the amount of lymph, while diminution of the blood supply, owing to stimulation of vaso-motor fibres or other causes, diminishes the amount. Muscles when in action, by their contraction and relaxation, favour the pouring out and the formation of lymph, which is absorbed by the tendons and the fasciæ, as they are so intimately associated with the intrinsic muscular elements, so that by the movements of these structures corresponding with the motions of the muscles, a suction pump-like action is engendered whereby the lymphatics are alternately filled and emptied while the lymph is propelled onwards. Please remember this, too, which is important, that *passive muscular movements* act in the same way.

The fascia covering the muscles consists of two layers of fibrous tissue with the lymphatics intervening. When a muscle contracts, lymph is forced out from between the layers of the fascia, while when it relaxes, the lymph from the muscle, carrying with it some of the waste products of muscular action, passes out of the muscle into the fascia between the now partially separated layers. The numerous valves existing in the lymphatics prevent any reflux.

In the case of those lymphatic vessels which begin by means of fine juice canals, the movement of the lymph must largely depend upon the tension of the juices of the parenchyma, and this again must depend upon the tension or pressure in the blood capillaries, so that the blood pressure acts like a *vis à tergo* on the rootlets of the lymphatics.

With these physiological data to go on upon let us see in what way they bear upon our general every day practice. Let us see how these lymphatics act as absorbents and aid our manipulations by the removal of the products of congestion and inflammatory changes, such as exudations, transudations, extravasations, adhesions, and the like of these. Petrissage, kneading and pressure movements act like a pump to force onward the flow of the venous blood and the lymph, and not only so, but the normal capacity of the lymphatic system to absorb is enormously increased by these mechanical processes. Pressure is the all-pervading element in absorption; pressure without, in plain words, is the antagonist of pressure within, active is far better than static pressure. Let me instance my meaning in a very simple manner. Given a case of chronic effusion into a joint, we can and we do frequently apply pressure to bring about absorption by carefully strapping the joint.

but this is a tardy and oft-times a very incomplete process. Compare it, however, with active pressure by means of manipulations, where the effused fluid, and it may be a certain amount of débris, is driven into the lymphatics through their stomata, whether the lymphatics are willing or no.

Mosengeil has studied this subject very carefully, and has demonstrated by direct experiment how powerfully absorption takes place by mechanical means (Von Mosengeil, "Langenbeck's Archiv für Klinische Chirurgie," 1878, 9 Band, 3 and 4 Hefte). I give you one of his experiments as quoted by Schreiber.

At 9 a.m. he injected a hypodermic syringeful of Indian ink into both knee-joints of a rabbit. The temperature in the rectum immediately following the operation was 100·8° F. At 9.30 a.m. the right knee was manipulated, the rabbit seeming unaffected by the operation, being quite lively and running about. At 9.45 a.m. both knees were again injected with the same quantity as before, but with a less concentrated suspension of the ink, and the right knee was again at once manipulated. The pain seemed more intense than with the first injection, the rabbit resisted violently and was hard to hold. The manipulation of the joint, too, seemed to be more painful. After manipulation, the knee previously swollen became of normal size again. It was noticed that the left leg, which, as a check experiment, had not been manipulated, was likewise less swollen after the rabbit had run about a while. At 3 p.m. injections were again made into each knee-joint, and the right knee manipulated as before. In two minutes the swelling of the right knee had disappeared, while the tumefaction of the left remained permanent. In the meanwhile the temperature had risen to 102·2° F., and at 8.30 p.m. it reached 104° F. However, to judge from its hearty appetite, the animal did not seem to feel very badly. At 8.45 p.m. the knees were again injected. It was now found that a whole syringeful could no longer be forced into the left knee, but readily entered the right, which was again manipulated. On the following morning half a syringeful of a thick suspension of the ink was injected into each elbow joint, both joints were manipulated, and the animal then killed and examined. In the upper extremities, the ink was found distributed in irregular patches, in the peri-articular connective tissue about the puncture, and extending into the subcutaneous tissue, and also upward along the vessels, and the inter-muscular septa. The axillary glands of one side were found to contain Indian ink, the lymphatics leading to them being intensely black. On the other side, on which a colleague had performed the injection, and attempted the manipulations, no ink was found in either the lymphatic vessels or glands.

Now from this experiment, which is often referred to, it appears to be possible, within the space of a few minutes, to remove a fluid injected into the knee-joint of a rabbit by manipulations which force it into the lymphatics. This is an exceedingly interesting proof of what can be effected by massage manipulations. It shows us clearly what active agents the lymphatics are in bringing about absorption. No doubt in this case of Mosengeil's the leucocytes were very actively employed. In order to make our massage movements with a fair certainty of success, we must manipulate as previously demonstrated, from the periphery to the trunk, in the course of the venous and lymphatic flow. Superficial effleurage and stroking movements can be performed either centripetally or centrifugally, but directly pressure is exercised all movement must be centripetal. We have, I hope, seen the reason for this, as far as blood pressure is concerned.

Let us for a moment consider the necessity of centripetal movement in reference to the valvular arrangement which we know to exist both in lymphatics and veins. We will take veins first. Most veins are provided with valves which serve to prevent the reflux of blood. We find the valves very numerous in the extremities, and particularly in the lower extremities where the veins have to conduct the flow of blood against the force of gravity. The valve is formed by a reduplication of the inner coat, its convex margin is attached to the wall of the vessel, whilst its concave margin is free to move in the course of the current of the blood. When regurgitation takes place the opposed edges of the valve come into contact, and by this means any return of the column of blood is effectually stopped. If the valves are unable to close perfectly they are said to be incompetent, inefficient, or insufficient; such a condition sometimes gives rise to venous pulsation. Veins, like other structures, are liable to inflammation, and the blood becomes clotted in the inflamed area; the clot may only partially, or it may completely occlude the lumen of the vessel. This is a point of very great importance for you to bear in mind, because, when such is the case, manipulations are quite out of place, and cannot be for one moment permitted; their employment may give rise to detachment of these thrombi, which, if conveyed into the circulation, may be productive of the most serious consequences. Whilst speaking to you of veins, let me draw your attention to varicosities of these vessels. We know by this time, that the current of the blood in the veins is dependent, not only upon the veins themselves, but also upon the integrity of the heart, the arteries, and the capillaries; whatever interferes with the passage of the blood through these channels will tend to venous dilatation and varicosity.

Hence the venous blood flow may be retarded owing to a weak and enfeebled right heart, or to any obstruction in the arteries; pressure upon veins is often a cause of their dilatation, such as a tight garter, the gravid uterus, an overloaded rectum, tumours and congestion of visceral organs, and last, but not least, to vascular spasm. I shall have to speak to you in a few minutes relative to congestions, and show you again how such are influenced by massage.

Varicose veins are exceedingly troublesome, and in some cases dangerous; the rupture of a large varicose vein not unfrequently causes death within a few minutes from loss of blood. The surgical treatment of varicose veins is not always satisfactory; hence you find a large number of persons with their limbs encased in bandages and elastic stockings, often, too, when they would be much better without them altogether.

From what we know of the circulation and the effects of massage in lowering blood pressure and in helping on the flow of venous blood, we ought to be led to the conclusion that massage might be of service in the removal of these dilatations; this is most indisputably the case, and its value in this respect cannot be over-estimated. You have seen its good effect so repeatedly amongst my patients that I will not say any more about it, except to draw your attention to a patient now under treatment for spastic paralysis. If you remember, she had a lump of varicose veins in the bend of the left leg; not only has the massage nearly cured the paralysis, but her varicose veins have ceased to be noticeable.

We believe that the massage processes are extremely useful in promoting functional activity in the lymphatic glands. These glands you must know are exceedingly numerous throughout the body, and when the blood becomes infected by poisonous matter, either from within or from without, it does seem that they are storehouses for such poisonous material; they become swollen and enlarged and frequently they are very painful. It is quite possible that the poison of syphilis and the determining agency or plasmic force of cancer and of tubercle may remain latent in these glands for years, or even for a generation, until some exciting cause calls them into activity. The clinicist knows full well how these glands are subject to infective processes, by determining laws with which at present we are not fully acquainted. Continuity and environment are the most common causes, but the infection may be indirect as well as direct. If our leucocytes could speak they would in all probability give us more definite information concerning these somewhat obscure and retrograde processes. There is nothing more wonderful to my mind than the rapidity with which a lymphatic gland will enlarge, and just as rapidly return to its normal proportions, when the irritating or exciting cause dies out or becomes removed. The sensitiveness of lymphatic glands in some people is truly astonishing ; the least source of irritation will set up in them a hyperplasia or adventitious cell growth, running its course of existence, and dying out without leaving a trace behind. Sympathy between glands is one of the common and most interesting and characteristic features. Dr. Groom, in a recent and thoughtful article in the *Lancet*, on "The Lymphatic System and Cell Agency," states : "I desire to maintain that it is to the lymphatic system and cell agency that most, if not all, forms of disease are due," and he gives fairly good evidence that this view has considerable foundation in fact. But I cannot afford to be impractical or hypothetical, for we have to deal with things as we find them rather than with things as we would have them to be. Tangibility and the revelation of the effects of massage upon disease must be the motto of the masseur, rather than the etiology and pathology of diseased states. (I assure you if I have any aim at all in these lectures it is that they should be free from assumption, that they shall be to you as food of the most assimilable kind, giving you intellectual and physical potential energy).

Now lymphatics and lymphatic glands, or "the lymphatic system," is more liable to disease than the other circulatory systems. Of course with the malignant forms we have nothing whatever to do, but with the conditions of chronic inflammation we have a very great deal to do, therefore I must bring these under your notice. The lymph and chyle have to pass through those glands on their way to the blood, so that should those glands become obstructed to the passage of these nutrient fluids, to put it in plain words, tissue starvation must result. The lymphatic glands form a chain of ganglionic nutritional foci of which it appears that the thyroid gland is the all-powerful and important link. I shall refer to this again at the end of this lecture.

There is, however, another point which strikes me as extremely probable. It is this. That there does exist a functional derangement in these glands, (notably uræmia) excited by the too rapid generation and death of leucocytes, and that the latter is the originating if not the source of those poisonous animal organisms which are the chief and main cause of autogenetic infection. Knowing that the healthy functional activity of a lymphatic gland plays an important part in the nutritive processes, and seeing that our manipulations upon the human body are attended by a great augmentation in the powers of nutrition and assimilation, we naturally come to the conclusion, although oft-times at the expense of cynical incredulity, that massage processes do stimulate and excite those glands to renewed energy when they are in an atonic state of existence. Functional glandular inactivity is of necessity co-existent with general failure of nerve power, apart altogether from subacute congestive and inflammatory changes to which the glands are particularly liable. It is quite possible also that the primary lesion in scrofulous and tubercular glands is due to these causes, and no one can say that simple anæmia, chlorosis, pernicious anæmia, and lymphatic leucocythæmia are not primarily due to functional inactivity of the lymphatic glandular system. Therefore you see it is necessary that we should travel somewhat ahead of those who believe that the Alpha and Omega of massage is merely to hasten onwards the lymph and blood flow. No doubt as in veins any impediment to the onward flow of lymph must give rise after a time to dilatation of the lymphatic walls, leading to varicosity, and possibly insufficiency of the valves, with regurgitation. Then, if you follow my ideas, I think you must agree with me, and absolute proof is by no means wanting to verify my statement, ·that all forms of functional inactivity, sub-acute and chronic inflammation, simple atrophy and hypertrophy of lymphatic glands are best treated by our massage manipulations.

I might perhaps in this lecture just call your attention to some forms of hæmolytic blood disease, such as anæmia, pernicious anæmia, chlorosis and leucocythæmia, which are sometimes so very difficult to cure. I have not had great experience in the treatment of these cases by massage, but I cannot help thinking that massage with oxygen inhalations and the galvanic current to the spine and spleen should prove a very efficient remedy; at all events I must say that I think it is deserving of trial.

Massage and galvanism are particularly useful in chronic congestions (hyperæmia). I have told you before that in my opinion you had better leave acute or active congestion alone; if resolution does not take place, and if pus is not formed from degeneration, if the blood vessels become relaxed and the circulation stagnant, then massage is more curative than any other agent with which I am acquainted. I need scarcely tell you that in congestion (of course I am referring to local congestions due in the majority of cases to dilatation of veins and lymphatics, which is often accompanied by transudation of serum and the migration of blood cells through the walls of the capillaries) the absence or occurrence of dropsy will depend in great measure upon the adequacy or inadequacy of the lymphatics to carry off the excess of fluid; the part so congested will frequently present a darker hue than the surrounding skin, usually it is harder, and will pit upon pressure, if the exudations have not undergone any general parenchymatous or fibroid change. By our massage movements we promote the absorption of the inflammatory products, and remove those disturbances of function to which they have given rise. This absorption, as well as the restoration of the diseased vascular wall, can only be obtained through the agency of an active interchange of blood in the diseased part, and stimulation of all the tissues therewith concerned.

The diseased vascular walls of chemically inflamed parts can only be restored to their normal condition by contact with normal healthy blood, it is therefore necessary for the massage manipulations to be commenced as soon as possible after the acute symptoms have subsided; from my experience the temperature of the part should be our guide. I do not think that we can rely very greatly upon the nature of the pain, neither can we depend entirely upon temperature unless we consider its variability; if during, say, twenty-four hours, we note that the local temperature varies, sometimes being normal, we may then conclude that carefully applied massage may be commenced, for by massage compressions and relaxations the currents of the blood and of the fluids are promoted, and a more rapid interchange of the streams is effected. By this means only can the processes of diffusion and absorption have fair play and the nutritive processes be advanced. When I have to speak to you of inflamed joints, I shall consider this question of congestion more fully. The next part of my lecture refers to dropsies.

When we speak of dropsies we mean the accumulation of fluid in the subcutaneous cellular tissue; this, as you know, is usually termed œdema or anasarca. When an effusion of fluid occurs in limited cavities it is usually named after the cavity in which it exists. I might say that dropsies depend upon the fact that more fluid is poured out from the blood vessels than the lymphatics are capable of taking up and returning again into the circulation; this arises certainly in the majority of cases from paralysis of the walls of the capillary vessels due to vaso-motor nerve inhibition. Ranvier's experiments have proved that ligature of the vena cava in the dog does not usually give rise to œdema of the lower limbs, but if one sciatic nerve is divided, the corresponding leg at once becomes œdematous; this is fairly good proof that so long as nerve communication is intact the lymphatics are able to absorb all the fluid which the capillaries can pour out, but when the nerve is divided the arterial tonus is arrested and œdema results, because more fluid is poured out than the lymphatics are capable of absorbing. Positive obstruction to the arterial circulation is not necessarily attended by dropsy, because the collateral arterial branches will in most cases compensate and carry on the flow, although in a round-about way.

There are some dropsies which seems to arise almost entirely from blood changes when the blood is thin and watery and of a lower density than normal. Under such conditions, when there is no impediment to the venous circulation beyond the mere weight of the column of blood, transudation easily takes place through the walls of the vessels. Of course it usually shows itself in the feet and ankles. We find that the swelling subsides after the body has been in the horizontal position, and it is absent in the morning, but marked at night after gravitation has overcome the lessened resistance. We must, however, remember that the general tone of the vessels is deficient and capillaries are oft-times dilated from this cause.

Let me tell you, if you please, that these forms of dropsy are best relieved by local massage, but general massage should be employed at the same time. There is no reason against the use of other therapeutic measures, such as iron and tonics, to improve the quality of the blood in those cases where such remedies are demanded. We look upon massage as one aid to treatment, and no physician would be so intolerant as to adopt one remedy to the exclusion of every other. In the curative treatment of disease our knowledge of remedies should be comprehensive, and our views should be unbiassed and free from bigotry, narrow-mindedness, and especially should we be free from prejudice. I shall never attempt to claim for massage anything more than I have found by experience that it deserves, and that reason and common sense dictate.

There is a form of œdema of the lower limbs which is frequently persistent, and which no tonic medicine or diet or change of air seems to relieve. I refer to the dropsy after some acute form of disease, which seems to be dependent upon a weak condition of the vessels rather than to the blood or to the heart; it cannot be due to a deficiency of arterial tonus alone. I was consulted not long ago about such a condition. The patient had suffered from typhoid fever, of a severe form; he was over fifty years of age, but he recovered, and as far as we could make out there was no organic change in any organ or obstruction to the venous blood flow; the heart sounds were normal, and the arterial tonus, judging from the pulse at the wrist, was also normal; his general strength was good, but the lower extremities were so swollen that he was unable to get about without considerable discomfort. I have told you that tonic remedies had been tried in vain. Now I am not exaggerating when I tell you that after masséeing the lower limbs for a week, this gentleman walked about with the greatest ease, and at the end of a fortnight he was quite cured. Surely this was no coincidence; nothing of the kind, it was a living, demonstrable fact, and it requires only the merest knowledge of the physiology of the capillary circulation, not only to explain the cause of the dropsy, but in like manner to show the rationale of the effects of massage upon the vessels in bringing about the cure. I will give you another instance, and this is only one of many of the same kind which I have seen. A lady consulted me about a swelling of the left leg from the foot to the knee, which came on gradually. The limb was quite painless and had been so from the first, all she complained of was the great inconvenience which it occasioned, she could not dance, and in fact she walked with considerable difficulty. This condition of the leg had been existing for nearly three months, and for a great part of this time it had been bandaged, without any good result. In other respects her health was excellent, the spirits were good, the appetite was good, and every function was regular and natural. The dropsy was local, and due to vascular paresis, there was nothing to indicate any hindrance to the circulation from plugging of vessels, there was unquestionably local vascular paresis. This lady rapidly recovered under the influence of daily massage to the limb.

I have now to draw your attention to a form of swelling of the lower limbs, usually the left, most frequently due in some way to, and associated with the puerperal state. Phlegmasia dolens, or white leg, as it is commonly called, generally comes on about the second or third week after delivery. At its primary and later stages it pits upon pressure, but in the intermediate stage it is hard, somewhat resillient, and elastic; its pathology has never been well defined. Now there comes a stage in the history of this disease when massage should be exceedingly beneficial and highly commendable. I am not, however, speaking from experience, so my advice in this matter must be taken for what it is worth; but I have seen these cases in years gone by, and I well remember how long it takes for these limbs to resume their normal condition, if they ever do so. I can certainly recall to my mind cases when the elastic stocking has been of necessity continuously worn. It is only reasonable to conclude, as is the case, that the limb remains for some time deficient in tone—circulatory, muscular, and nervous. Sometimes there is a persistent œdema left behind, with and without deficiency of muscular power. The limb may undergo a considerable amount of wasting, and the cellular tissue may be hypertrophied, from a proliferative hyperplastic organization. Of course in manipulating the tissues the movements should be performed with more than ordinary care, they should be made with great steadiness, even slowness, definiteness, and precision; in fact the pressure should be applied direct upon the tissues rather than in a centripetal direction. If the pressure be applied in a jerky, ill-timed, thoughtless, and careless way, thrombi may become detached, which, if carried into the circulation, may be productive of very serious consequences. You will no doubt have many opportunities of proving the good effects of skilful massage in these cases, and your manipulations can be well aided by faradization to the weakened muscles. I saw some months ago a case of persistent swelling and hardness of the right leg and thigh in a young lad about seventeen years of age, due to inflammation of the veins, and certainly massage and faradization were most effectual in bringing about a cure, although the treatment had to be carried on for nearly two months. In all these conditions there is of course the chance which must never be forgotten, namely, that some of the partially organized matter, as I have before told you, may be carried into the circulation, and I should be sorry in any way to under-rate the importance or the consequences which may follow such an unfortunate event, but I really think with due care this may be avoided. I have had no experience of massage in the treatment of dropsies of cavities except the cavities of joints, and to these I shall refer when speaking to you of joints. Some cases have been recorded where massage has been used successfully in the treatment of ovarian dropsy, but I know nothing about it, I cannot therefore recommend it to you, and I certainly do not advise you to try it; the statement would be interesting however if it could be verified.

Before leaving the subject of dropsy, I must direct your attention for a few minutes to œdema due to heart disease or to some obstruction in the lungs. Where there is defect in the tricuspid or mitral valves of the heart, associated with dropsy, there is some imperfect closure of the valves and widening of the orifices, giving rise to a backward or regurgitant flow of blood, by which the venous circulation throughout the body is obstructed: this is particularly the case when there is disease of the right side of the heart, with dilation of the right ventricle dependent upon obstruction to the flow of blood throughout the lungs. Dropsies which arise from defect in the circulation of the blood through this side of the heart, generally make their first appearance in the feet and lower extremities where the greatest obstruction to re-absorption takes place. It is self-evident that in valvular disease the perfection of the heart as a pumping machine must be seriously interfered with, and this want of co-ordinate sustaining and rhythmical action must necessarily disturb the normal relationship which should exist between the arterial and venous circulations; but these deficiencies are often made good by what is known as compensatory action. It is well known that extensive valvular disease may exist without giving rise to any very serious changes in the circulatory system, and this state of things may go on for years without the patient feeling any discomfort. But without compensation this could not be, valvular disease must give rise to increased resistance in one direction and lessened resistance in another, in front of the lesion there is less blood, and behind it there is more blood. All lesions of the valves of the heart enrich the venous circulation at the expense of the arterial.

All resistance to the movement of the blood through the various compartments of the heart and the vessels communicating with it, must cause more work to be thrown upon the portion of the heart specially related to this part of the circulatory system; hence we find an increased thickness of the muscular walls. It is this hypertrophy which gives what is called compensatory power to the heart, and enables it to overcome the increased resistance which the valve complication originated; plus resistance minus compensatory power is the first cause of dropsy from heart disease. To increase compensatory power and to lessen resistance is the first and chief aim in all and every form of treatment; in other words, to relieve undue pressure and venous stasis, which are the causes of those serous transudations, which we know as dropsies, and which are in excess of the normal power of the lymphatics to absorb. We know that the tendency in valvular disease of the heart is to upset the balance of power between the venous and arterial currents, the quantity of blood in the arterial system is lessened, whilst in the venous system it is increased to overflowing; this, of course, extends to all parts of the body, but it first makes itself evident in those dependent parts in relation to the common law of gravitation and the pressure of the column of the blood. Dropsies of the viscera and internal cavities follow in progressive and developmental order, in direct ratio with the exercise of the mechanical laws to which I have just alluded. It is well to remember that compensation and dropsy cannot go on together. Dropsy is a sign that compensation has done its best and failed; but it is not a sign that all efforts at compensation have ceased. If we relieve the blood pressure by stimulating the circulation through the veins, and by stimulating the lymphatics to increased absorption, and the skin, the bowels, and the kidneys to increased activity, we can lessen resistance and re-establish compensation.

Well, so far, I have endeavoured in a very rough and humble sort of way to give you the merest outline of some points relative to certain changes in the circulation, the result of valvular disease of the heart. Now I wish to tell you that massage is not contra-indicated in any form of heart disease with which I am acquainted, unless it be in aneurism or the extreme fatty heart. On the contrary, I shall have very little difficulty in explaining to you that we have in massage a valuable means of restoring to the heart and to the circulation, locally and generally, the very qualifications which they so much need, the lessening of resistance, and the establishment of compensatory power. I need not say anything to you concerning the manipulations that are necessary, they are as I gave them to you in my second lecture. The first effect of massage, then, in œdema is to relieve the veins, to free these distended vessels and their dilated walls, to remove the pressure of the blood, to stimulate the vaso-constrictor nerves into activity, and increase the absorptive energy of the lymphatic system; by so doing you increase the balance of power between the venous and arterial circulations, which is one important step towards altering venous stasis; the vascular tonus cannot fail to be increased, and the heart is thus relieved of a certain amount of inertia from which it has been suffering in consequence of that resistance which its efforts at compensation have failed to overcome. Massage, then, is of value in dropsy. If the œdema of the skin and areolar tissue be removed by this method, you may rely upon it every part of the body will be similarly influenced. Function will be restored, and your patient's condition will be improved. But I tell you again, as I have told you before, and I cannot impress this upon you too strongly, we look upon massage only as one means of treatment; therefore in this, as in other diseased states, promote and stimulate the action of kidneys, bowels, and skin, by diuretics, diaphoretics, and hydragogue cathartics.

There is a form of disease known as myxœdema, which I must now bring under your notice; it has received considerable attention by a committee appointed by the Clinical Society to investigate its nature. During my career at the Central London Sick Asylum I had many opportunities of making observations upon patients suffering from myxœdema, both from the clinical and pathological side. I have seen several cases lately in private practice, which have derived immense benefit from massage and galvanism, therefore I believe firmly in this mode of treatment over any other in this disease. We must not forget that there are types of myxœdema, some presenting every characteristic feature, others, again, which are marked only by certain of these signs. You might be inclined to infer that this is merely evidence of various stages of the disease, but, in my opinion, this is not the case. Therefore I would maintain that up to the present time the clinical features presented by these varieties of type have not been fairly and fully elucidated. The term myxœdema, however, is applicable to these various forms, and denotes what are really the most prominent pathological changes, namely, "the invasion of the tissues of the body by a jelly-like mucous yielding dropsy." In the very elaborate and able report of the Clinical Society's proceedings these changes are made clear and evident—and it does credit to the labour and research of British medicine—so that myxœdema, as we now know it, by clinical and pathological signs, is an established disease with an entity of its own. Still I feel sure that it is capable of further division. The most interesting fact in relation with these changes, which are principally brought about in the connective tissues of the body, is the part played by the thyroid gland, and a mass of evidence of all kinds has been brought forward to substantiate this association. If the thyroid gland undergoes removal, destruction, or degeneration, the signs and symptoms of myxœdema invariably follow.

The pathology of myxœdema is fairly substantiated. It consists in the interstitial development of fibrous tissue throughout all parts of the body, particularly in that of the skin, increasing notably the bulk of the body, distortion of the features, and the hands and feet; yet it appears that pathology, up to the present time, affords no explanation of the affections of speech, movement, sensation, consciousness, and intellect. This being the case, How are we to account for these marked defects, which should be indebted to some definite factor in the nervous centres; and why, may I ask, according to some unknown pathological law, should the connective tissue of the brain and spinal cord not be included in these changes, when they are common to every other portion of the body? For my own part, although these changes are not discoverable after death, I have long thought, and still think, that an excess of mucus does exist in this disease in the nervous organs prior to any objective clinical manifestation. We have clearly very much to learn concerning the etiology and relative pathology of this disease, and it may come out after all that the nervous system is the *fons et origo mali*; still we are bound to admit, and I for one readily do admit, that the evidence is, so far, against any such theory. Etiology and association are so bound up with cause and effect, giving rise to complex differentiations and degrees, that synthesis of desire to formulate often exceeds the deep scrutiny necessary for analytical deduction.

I was told only the other day of a leading physician in the North, who, when asked a question concerning some point in medicine or physiology, invariably answered in the same way, "I do not know." Now this physician is admittedly a man of consummate intellect. But I must not forget my duty, and that is to tell you how to cure myxœdema, if it is to be cured at all. Out of a hundred and nine cases of myxœdema tabulated by the committee of investigation in their report just issued as part of the Clinical Society's proceedings, I do not find one case of cure, and only very few where any improvement was manifested. I do not know what you think, but from the patient's point of view I consider it extremely unsatisfactory. The treatment consisted chiefly in the administration of cod liver oil, nervine and blood tonics, iodide of potassium, nitro-glycerine and jaborandi, and, as you might suppose by the influence of the latter drug upon the skin, it seems to have been productive of some benefit; not one single case was treated by massage, and only two or three by galvanism.

In the fall of 1886 I was consulted by a lady about fifty years of age, who was sent to me by Dr. Philpots, of Bournemouth. The moment I saw her it was evident to me that she was suffering from myxœdema; her tottering gait, puffy face, masque-like features, hesitating speech, and pallor of skin but not of lips, were quite sufficient to indicate to me the kind of case with which I had to deal. Her husband was in great distress, as he said the whole thing came on so suddenly and a physician whom he consulted gave him a very hopeless prognosis. I consider in this case that all the signs and symptoms, objective and subjective, were well marked, memory, temperament, sleep, motion, and sensation. She had a skilled masseuse to live in her house, who massaged every part of the body for one hour twice a day, and in the morning the limbs and spine were well faradized; all the medicine she took was an alkaline bromide powder at bedtime. After a month's treatment she improved, and at the end of three months her features had returned nearly to their normal condition, her walk was still a little shaky, her voice was clear, the hesitancy of speech had gone, she could walk for half a mile without suddenly falling down, whereas before she could not walk a hundred yards without support. The massage and galvanic treatment was continued for six months, and I might say perfect recovery took place.

A gentleman over fifty years of age, who had been my patient for a long time, suffering from nervous exhaustion and (as diagnosed both by Dr. Hughlings Jackson and myself) lateral sclerosis of the spinal cord, with some mental defects, consulted me one day on account of swelling of the feet. I had not seen him for over six months, and I remarked to him, "How stout you have got." "Yes," says he; "What does it all mean? I am better in many ways. I can walk much better, and I feel more cheerful and comfortable in myself, but look at my hands, they are like legs of mutton." And there, undoubtedly, was the square spade-like hand of myxœdema. The feet were not œdematous, but they were like the hands, swollen and enlarged, and the toes were like the fingers, remarkable for their squareness of outline; the features, too, were undoubtedly symptomatic. Well, I saw this gentleman the other day, and he is now quite free from myxœdema; there might be some slight thickening and blurring of the features, but the hands and feet have returned to their normal state, and, oddly enough, his paralytic symptoms have gone.

In the spring of last year I was consulted by a lady, aged thirty-four, married, with children. She said her health had been failing for three or four months, and she thought worry had to do with it. Her speech was thick and hesitating, and sometimes she used one word for another. At times she was unable to walk straight, and her husband would chaffingly tell her that she had taken a little *too much*. Upon careful examination it was evident that the skin of the face and of the hands was thicker than normal, and remarkably pallid and wax-like. The lips looked thick, but were of a good red colour, in striking contrast to the colour of the skin; she was obtuse, and the memory was decidedly defective. She told me that she had taken no end of medicine, which did her no good, and after some hesitation she consented to undergo a course of massage and galvanism. The body was massaged all over for one hour night and morning, and the combined current was applied by means of a foot bath, the negative pole being attached to the bath, which, as you know, is made of metal, and the positive pole was applied to the nape of the neck, in the form of a long electrode of metal, covered with chamois leather. No medicine was given, and by the end of six weeks she was practically well. I could bring under your notice other cases of a similar character to these, but I think you have had enough proof that in these varieties of myxœdema, massage should be thoroughly and persistently tried, either with or without galvanism. I have the greatest faith in this form of treatment in this disease when entrusted to skilled hands.

LECTURE VII.

THE WEIR-MITCHELL TREATMENT.

The Introduction of the Weir-Mitchell Treatment—Influx of Masseurs and Masseuses—Instruction in Massage—Example of the class of Patient to whom this Treatment is Applicable—Diagnosis of Proper Cases for Massage—The Psychical Element in Weir-Mitchell cases—Fat—The nature of fat—Massage Especially for Hysteria—Physicians as Masseurs—Dr. Hale White on Massage—Dr. Seguin on Massage—Seclusion—Rest—Massage—Dosage of Massage—Electricity and Galvanism—Feeding—Some Points of Importance for Consideration.

WHEN more than twelve years ago we first received tidings from Philadelphia of an original mode of treating certain forms of nervous disease specially known as hysterical, by seclusion, rest, over-feeding, massage and electricity, they were received with considerable incredulity and doubt, and had they been associated with any other name than that of one of the most eminent physicians in America, it is quite possible that we should not at the present time have heard very much about it. For years it was allowed to slumber and to smoulder, until Dr. Playfair applied the torch, when, in a very short space of time, it was burning brightly, and now there is scarcely a town in this country where there does not reside a living monument standing out as a record of its well deserved reputation.

It is only natural to find that this form of treating disease, which has been attended with such marked and unprecedented success, in some cases almost miraculous, should have given rise to a large following of people, calling themselves masseurs and masseuses, and the physician in truth cannot possibly do without them. Some are thoroughly qualified for the work, and others are utterly unsuitable. Of course this is to be expected, but as time goes on the chaff will be sifted from the grain, and only those who are best qualified and accomplished in their work will remain.

I have studied massage, with and without electricity, for many years, long before it became notorious, and it has been my delight to impart my knowledge to others, and my class is composed only of those who are blest with a good physique and sometimes with more than an average amount of intellect. I am in no way ashamed of my occupation in this direction, for I am confident that if massage is to take its place as a therapeutic agent its manipulations must be carried out by those skilled and practised in its use; but there must be a system and a science in everything, and the treatment of disease by massage in a perfunctory way, without a complete and systematic knowledge, simply leads and gets the whole thing into discredit, and also, unfortunately, involves those who have associated their names with it. There is, however, some consolation in knowing that it has been the means of curing a large number of nervous disorders which were looked upon as hopeless and incurable.

It is my object and my desire to make you acquainted with all that I know, both from my own experience and from that of others, in reference to what we now recognise as the "Weir-Mitchell Treatment." Of course we are already acquainted with all forms of massage manipulations, how they are to be applied, when they are best applied, and what are the usual effects produced by their application ; we have also considered the influence of massage more or less upon the temperament and upon the character. Now, I have told you more than once with reference to massage, that just as we build up the physical side of the human body, and just as we restore the functions of the muscles, so we also improve and restore the integrity and the normal balance which should exist between the mind, on the one hand, and the body on the other, so that by our mechanical manipulations upon the physical side of our existence we also hope to restore derangements in the mental processes which are so intimately connected therewith.

I will first draw your attention to one or two points upon which Dr. Weir-Mitchell lays some stress. He says that his treatment is particularly applicable to a certain class of cases, and "the cases which I have treated have been chiefly women of a class well known to every physician—nervous women, who, as a rule, are thin and lack blood. Most of them have been such as have passed through many hands and been treated in turn for gastric, spinal, or uterine troubles, but who remain at the end, as at the beginning, unable to attend to the duties of life—a source alike of discomfort to themselves and anxiety to others." This is a text upon which any medical man could easily preach a sermon. No man can have been in practice more than six months at the very outside without coming across some cases precisely similar to those referred to by Dr. Mitchell. They are constantly presenting themselves to the physician's notice. They form a class of invalids who really do a great deal to support the doctors. Their temperament becomes so morbid that nothing can soothe them, nothing can quiet them, nothing, apparently, can do them any good but the assurance that they have a doctor at hand who, in case of trouble, will be equal to any demand made upon him.

We may say that the particular cases, then, which come under the Weir-Mitchell treatment are people suffering essentially from a weak condition of the nervous system,—an unbalanced condition of the nervous system, weak, not so much in intellect or in body, but weak whenever their nervous system is strained, it does not matter from what cause. They break down easily. They are generally people with spurts of energy, but this energy with which they are endowed is incapable of any prolonged and sustained effort. In all probability there is some hereditary cause for this. There may be a family history of alcoholism, insanity, epilepsy or diabetes; causes which we know are likely to give rise to an unstable, erratic and ill-balanced nervous system, commonly known in women as hysterical. At one time they may be bright, happy, and cheerful, and pleased with everybody and everything; they are frequently highly intellectual and accomplished, and the very soul of the society in which they move and have their being—still they are usually almost morbidly excitable. This may go on for years, with occasional exceptions of headache, lassitude, weariness, sleeplessness and sudden emotional outbursts, the cause of which seems inexplicable, when a change comes over the scene, some disturbing element arises, it may be of a slight nature, leading to grief, jealously or fear, and the once jubilant, gay, cheerful, high-spirited, light-hearted woman is converted into the very antithesis of her former self. She becomes retiring, and shuns her former friends and associates; her occupations, which at one time gave her so much pleasure, are now forsaken and cast aside; her chief aim is to be alone; her features grow careworn and pale; her appetite fails; the least thing tries her, and she appears indifferent to those formerly most dear to her; she is usually to be found lying upon the couch; every movement seems to be associated with effort. To move wearies her; to read wearies her; to play the piano wearies her; to eat and even to speak weary her; and so the day passes, in dream-like monotony. She is tired on going to bed, and in the morning after a sleepless night feels still more tired, until finally she takes to her bed altogether. Tonics are prescribed and possibly never taken, sleeping draughts are sought for with avidity, and, unfortunately, morphia is largely given to relieve imaginary pains. The bowels become obstinately confined, and the stomach is so irritable that nothing remains within it; everything taken feels like a dead weight. So matters not unfrequently go on from day to day, from bad to worse, until the hopeless, exhausted, and emaciated creature seems to be living a life more like that of an automaton than a human being. If we examine carefully this patient's physical condition, one great feature is slowness and weakness of the circulation, coldness of the body generally, but particularly of the extremities, an icy coldness. The palms of the hands and soles of the feet are bedewed with clammy sweat, the skin of the body is dry, wrinkled, shrivelled and parchment-like to the touch. The muscles are wasted and flabby and quite unequal to any sustained effort. Her friends are constantly watchful, anxious and solicitous, and both they and the nurses are wearied with their constant efforts to do something, which is generally declined and no sooner declined than called for. This is by no means a fanciful picture of a "Weir-Mitchell case," and it is a condition which seems to be a basis for other superstructures. Manifestations analogous to those of central nervous disease are sometimes added to the above, and in some cases it requires intuitive skill and experience to determine the exact nature of the disease. We may have a simulated ataxic paraplegia, or disseminated lateral sclerosis. In the consideration of what cases are, and what cases are not likely to be benefited by this treatment, we must be as careful as possible to exclude all sources of error; still, however careful we may be in diagnosis, there are some cases which baffle even the most consummate skill, and my rule invariably is, when in doubt, to have the benefit of a second opinion, and, if still in doubt, to explain the whole matter clearly to the friends, so that all misgivings and misunderstandings may be averted. When in doubt the massage treatment should be had recourse to, and after a few months, if no decided improvement takes place in any way, it should be discontinued, and the patient relegated to the class of incurables.

Let me tell you this frankly, I would much rather have thoroughly good cases to treat, such as I have just depicted, than half and half cases, for they usually yield much more rapidly to treatment, and the cure of them is considered much more wonderful than is the cure of the latter.

I would like to say a word or two relative to other cases adapted to the Weir-Mitchell treatment, and I shall then briefly refer to those that are not so adapted. I am not going to give you the history and treatment of many cases, I would rather endeavour to lay before you the characteristic features upon a broad basis, by which means it seems to me you will the better comprehend what a Weir-Mitchell case really is.

Now the first thing above all others to be settled is this: Has the patient any organic disease upon which the illness or state of the body depends? Is there organic disease of either the brain or the spinal cord? Again: Has the patient any uterine or pelvic trouble which may possibly influence the treatment? Has the patient anything upon her mind which is just as likely to mar its effects as would some serious uterine displacements? At all events, before I commence treatment I endeavour to get these points cleared up; it is simply cruel, to say the least of it, to place patients under an expensive course of massage if there be no chance of its proving beneficial. Strangely enough, one morning last week I was consulted by a man in the prime of life, a country gentleman, well built, of florid complexion, and altogether of excellent physique, muscles hard and with a grasp of iron. His chief complaint was despondency and dread. He had heard of the massage treatment, and was greatly surprised when I told him that I thought it would do him harm. The cases which are most likely to receive benefit from the Weir-Mitchell treatment are those where nutrition is defective. Massage always benefits weakness and feebleness when the cause is due to arrest of function.

We can scarcely hope to be successful in those cases of hysteria which have advanced beyond the border land of sanity. Here we have to use great discrimination, not only in diagnosis, but also in the application of treatment. I know it is a common practice with those who ought to be better acquainted with a scientific system of massage and all that pertains to the Weir-Mitchell treatment, to serve all cases in the same way, without due regard to the psychical elements which materially avert the success we hope will attend our efforts. This is a great and serious error; for, as we have seen that it is essential and necessary to guard against any obstruction on the physical side, so have we to adapt our methods to antagonizing influences on the psychical side. Every case has to be and must be treated upon its especial requirements. No one would be foolish enough to expect remedial results from an irrational mode of procedure, but in many cases of signal failure which have come to my own personal knowledge, those failures have arisen simply from want of system and a due appreciation and consideration of cause and effect, and the cases have subsequently yielded to a treatment supported by a careful discrimination of their necessary requirements, and the application of methods associated with, though in some ways divergent from, the integrity of a system which cannot be counted upon as applicable to *all* forms of either mental or physical derangements, although in the main the principles of that system have been sound and irrefutable. It must not be forgotten that in those cases which we believe to be suitable to the Weir-Mitchell treatment there is a marked mental disturbance. I never yet met with a case of hysteria where there was not, and although up to the present time I have not ventured to treat a case of confirmed mania by this system, still I believe and hope that before long some man will arise with an inventive mind like Weir Mitchell and organize a system of massage by which the psychical side of our nature may become as amenable to treatment as the physical. Hopeless as it may now appear, this result may yet be attained.

The main points for thought and reasoning in the Weir-Mitchell system of cure are *rest*, *feeding*, *seclusion*, *massage*, and *galvanism;* but before considering these I should like to make you acquainted with one or two facts relative to the changes in tissue which we know are brought about by our manipulative modes of procedure. A word or two about fat.

No one, I think, can deny that some fats are wholesome, whilst others are unwholesome. Weir Mitchell writes of an old nurse who assured him that in her experience "some fats is fast, and some is fickle, but cod oil is easily squandered," therefore, as he says, the fat of an obese anæmic person may vary from the fat of a fat and florid person. "The flabby relaxed state of many fat people is possibly due, not alone to peculiarities of the fat, but also to want of tone and tension in the areolar tissues which, from all that we know of them, may be capable of undergoing changes as marked as those of muscle. I think there can be little question about there being fats which are stable and firm, and fats which are prone to rapid disintegration and absorption. This must be the case, I should presume, for some of my patients have lost fat rapidly after the massage treatment has been discontinued, whilst others have maintained the gain when the conditions of treatment have been precisely similar. One thing we must bear in mind, and upon which Dr. Mitchell seems assured, namely, "That increase of fat, to be a wholesome condition, should be accompanied by gain in quantity and quality of blood, and that while increase of flesh after illness is desirable and a good test of successful recovery, it should always go with improvement in colour. Obesity with thin blood is a most unmanageable condition." We must not forget that a person under massage treatment if he is by heredity of the lean kind cannot hope to gain fat after the same rate as a person who by heredity is prone to develop a superabundance of this material. I have a lady about thirty years of age at the present time under my care, who was excessively thin prior to undergoing the Weir-Mitchell treatment, and during the course she gained only five pounds in weight; but shortly afterwards she increased in weight with enormous rapidity, on account of the sudden and rapid development of fat; this was attended with the manufacture of good blood and a general improvement in health. We know of many cases of hysterical women who have lain in bed and apparently eaten nothing, and yet they have grown immensely fat, but it has not been good fat, they have been pale and anæmic and *given* to vomit blood, and how they gain in fat is oft-times mysterious. Fat gained by massage is almost always accompanied by gain in blood, that is to say, "massage fat" is the best of all fat.

There are some cases which are greatly benefited by the Weir-Mitchell cure, who have nothing very special the matter with them, certainly they have no marked hysterical symptoms; women who very easily get tired, and complain of vague pains, particularly in the back, spine, and head, who constantly suffer from dyspepsia and constipation, and to whom life seems a burden. They know and feel that they suffer from nervous exhaustion, they have taken no end of medicine, visited every Spa in Europe without becoming in any way changed, and they remain for years feeble and for ever tired. For them, as for the whole class, the pleasures of life are limited by this perpetual weariness, want of resolution, and failing resistance. The mode of applying massage in these cases does not vary from the methods with which I have already attempted to make you acquainted, but I would have you bear in mind that, as these hysterical cases improve and gain in fat and weight, the massage manipulations must be increased in strength, especially to the muscles of the back and the buttocks. You know we all have different ideas concerning, not only the value of massage, but the mode of manipulating also. There are some physicians who declare it does not matter how massage is done, so long as the muscles are well thumped, beaten and punched about. Dr. Graham writes as follows: "It is to be regretted that physicians do not oftener try their hands at massage themselves. They would be fully indemnified for their time and trouble in the improvement of their *tactus cruditus* which would enable them to appreciate the changes in the tissues brought about by massage, and this would open a new and interesting field of observation to them. Furthermore, the benefit of their visit would then be immediate in place of mediate, as when it is the medicine prescribed and not the physician that does the work; and a still greater reason is, that they would often prevent their glory from departing to another, and that other frequently an ignorant and obnoxious layman, whom the physician is obliged to tolerate or lose the family practice."

Although I do very little massage myself, still I quite agree with Dr. Graham that those who do not know should not attempt to teach. Dr. Hale White, assistant physician to Guy's Hospital, in a clinical lecture on a severe case of hysteria treated by massage, over-feeding and isolation, published in the "British Medical Journal" for July 30th, 1887, gives the following instructions to his class in reference to massage, which to me has a very comical aspect. He says : "You will probably perform it very much better if, remembering what you wish to effect, you set to work as you think best, than if you follow many of the quackish descriptions in print. When you have to instruct a nurse, *it is best to give her some definite method* and perhaps *something like this* is as good as any : First grease the parts with vaseline or oil (what is this for ?), and if the skin be *very* hairy it may be necessary to cut the hair; then stroke the muscles firmly several times with the *edge of the hands* in the direction of the venous flow. *In places where this is impossible, such as the back, always stroke in the same direction* (what does this mean ?) ; on the abdomen follow the course of the colon ; next you may take up the skin between the thumb and forefinger *and rub it between them*, one hand following the other in the same direction as the stroking ; then thoroughly knead the muscles with one or both hands according to the size of the part, in the same direction as already mentioned ; after this move all the joints in every direction ; then you may conclude by striking the muscles with several small blows, but this is not of much importance. The full time should be about an hour twice a day for the whole body. If there be a painful spot, and the case is one of hysteria, particularly direct your energies to this part. Of course, you will teach the nurse to avoid the bones. I have left out all the uncouth terms that are often applied to massage, in order to make it as simple as possible."

I have given you word for word an instance of how massage is taught in one of our greatest London Hospitals, and of its value, or the effect such teaching can have upon the minds of students, you can judge for yourselves. The eminent physician, Dr. E. C. Seguin, in the "Archives of Medicine" for April, 1881, says that even in New York there are few manipulators who can be trusted to do massage well. Non-medical people may become expert and skilful in the individual manœuvres embraced under the term massage ; but they ought to have their efforts directed by a physician. Physicians, in addition to want of time, may lack the necessary qualifications for doing massage well ; but they would often find it to their advantage to be their own mechanics as well as architects in this, as already intimated. You know I always advise my pupils to practice the different massage manipulations upon each other ; it is the only way to learn thoroughly. And never forget that all procedures should be commenced with moderation and gentleness, and that their force should be gradually increased as the patient gets accustomed to them. But I have made you so conversant with all this by teaching, by demonstration, and by practice, that I need scarcely say anything more to you about it.

We have considered our patient who is to be put under the Weir-Mitchell treatment, and we know the remedies which we mean to adopt for her cure. Let us analyse the nature of these remedies, and the effects they are likely to produce upon the patient.

Seclusion.—In the matter of seclusion, I am entirely and absolutely in agreement with Weir Mitchell; and it undoubtedly forms the basis of his cure. These hysterical and nervous people must be disentangled from the meshes of their old habits, and removed from contact with those who have been the willing slaves of their caprices. This is true, and has been thoroughly and completely borne out in practice. For years I failed in curing these hysterical cases, because I was unable to remove them from their friends and their surroundings, which had become part of their life of sickness. During the past summer I cured a very bad case of hysteria; but I had the greatest difficulty in removing the patient from her friends and adopting a system of isolation. The mother's words were: "If she must die, pray let her die at home. I cannot be separated from her while she lives." Fortunately, good counsels overcame the mother's scruples, and her daughter was completely isolated for one month; and in three months she was completely restored to health. The importance, then, of isolation in purely hysterical cases must be absolute. When cases of this kind come under my care for the Weir-Mitchell cure, the first thing which I sometimes see upon entering the room is no end of photographs of the patient's friends. These are at once taken bodily out of the room without the slightest comment, and so are books in which sympathetic verses from friends are written. We must break the chain which has for such a long time truly been the means of binding the captive in captivity. No letters, or messages, or any other forms of communication are permitted; and neither threats nor entreaties must overcome the confidence of the nurse in this matter. Of course, in a large number of cases seclusion is not required, especially where we have merely exhaustion, with pallor and dyspepsia, and with no special loss of tissue. Therefore you see we have patients for whom isolation is absolutely necessary, and others for whom it is not.

The cases *demanding* separation from friends belong particularly to the hysterical, though not necessarily to the emotional class, where the morbid condition of the mind is co-relative with bodily defects. But when the mental condition is worse than the physical, then absolute seclusion is unwise and unjustifiable. I do not say that the Weir-Mitchell treatment is unjustifiable, but only *the seclusion item of it.*

Rest.—At first sight it may seem strange that the cure should in part consist of rest, absolute and complete rest; the patients not moving except to perform the ordinary offices of nature. They are fed like children, and must in this, as in all other matters, be made to feel themselves subordinate, and to practise and exercise obedience and self-restraint. In this way we are helping to rebuild a shattered moral constitutional state, which is equally as important as restoring the physical part of their being; but we work on both at the same time, hoping and believing that we shall repair the mental in direct ratio with the physical. Many of these patients, it must be remembered, have been lying in bed for months and years, but they have not been at rest. On the contrary, they have suffered from great inquietude, having so given way to a chronic feeling of discontent that they have been almost constantly alternating between agitation, peevishness, fretfulness, and outbursts of really uncontrollable temper; or moody, morose, and in a condition of unrest, possibly from imagining themselves neglected, when in reality those about them have been half dead of exhaustion, fatigue, and distress on their account, ever trying to please them, but always failing. "Let us think, then," says Dr. Mitchell, "when we put a person to bed, that we are lessening the heart beats some twenty a minute, nearly a third: that we are making the tardy blood to linger in the by-ways of the blood round, for it has its by-ways; that rest prone binds the bowels and tends to destroy the desire to eat, and that muscles in rest too long get to be unhealthy and shrunken in substance. Bear these ills in mind and be ready to meet them, and we shall have answered the hard question of how to help by rest without hurt to the patient."

We must not, then, forget, and of course it is apparent to the most superficial observer, that confining a patient to absolute rest in bed, must, under ordinary conditions, be productive of a serious train of evils: exhaustion and debility are increased, the muscles become feeble, the joints stiff, the bowels constipated, the appetite impaired, the circulation enfeebled, and digestion and assimilation weakened. But we shall see in describing this treatment how these evils are overcome. What we want is a maximum of rest with a minimum of unrest of function. I have constantly been endeavouring to impress upon you that the healthfulness and activity of a part depends upon the due performance of function. If the natural function of a part be withheld its integrity becomes weakened and impaired. Nutrition and function work together. Many people suffer from indigestion because they give their stomachs too little work, and many also suffer from indigestion because the stomach is asked to accomplish more than it is able to perform. But we have considered, and shall be constantly considering, this question of supply and demand, knowing that an exact balance between the two is essential to health.

To exemplify this let me give you one of Dr. Weir Mitchell's own cases: "Mrs. P—, aged fifty-two, was brought to me from New Jersey, having been supine in bed for fifteen years. I soon knew that she was free from disease, and had stayed in bed at first because there was some lack of power and much pain on rising, and at last because she had the firm belief that she could not walk. After a week's massage I got her up. I had won her full trust, and she obeyed or tried to obey me like a child. But she would faint and grow deadly pale, even if seated a short time. The heart beats rose from sixty to a hundred and thirty, and grew feeble; the breath came fast and she had to lie down at once; her skin was dry, sallow, and bloodless; her muscles flabby; and when at last, after a fortnight more, I set her on her feet again, she had to endure for a time the most dreadful vertigo and alarming palpitations of the heart; while her feet after a few minutes' feeble walking would swell so as to present the most strange appearance. By-and-by all this went away, and in a month she could walk, sit up, sew, read, and, in a word, live like others. She went home a cured woman."

In this case we have an undoubted and typical example of the evil and pernicious results of prolonged rest, vitiating, though not annihilating, every healthful function of the body. And we have also a complete and teaching instance of the good results which can be produced by a treatment thoroughly and systematically carried out, under the observation and by the skill of a highly practical physician.

I am endeavouring to exemplify and teach you Dr. Mitchell's system, and for this reason: I should fail in my great indebtedness to this accomplished man, if I gave you my experience rather than his own; and in making it appear to you that my success was due to my own powers, rather than to his original and thoughtful mind. I shall have, however, something to say to you upon some points in reference to this system, which my study and increasing knowledge of these cases have made evident to me.

Massage.—I have said so much to you about massage, and in the course of these lectures I shall have to say such a great deal more, that I need scarcely allude here to the manipulations themselves. It is far better for the nurse in attendance upon the case *not* to be the masseuse. There are many reasons for this. In the first place the nurse must be selected who has special qualifications; she must have a will of her own, and the patient must be caused to feel that the nurse is the machine by which the doctor's mandates are to be unhesitatingly and unflinchingly executed; firmness and integrity of purpose are most essential attributes. Very much, then, depends upon the nurse, and no seductive or truckling influences of the patients should for a single moment allow her to neglect her duty; the physician himself should be the only court of appeal. I do not agree with taking morning and evening temperatures and noting variations of pulse, taking specific gravities of urine, and so on. Examinations of this kind may be made once, after the weight has been taken, with any other physical observations which may be deemed interesting and useful for clinical record; but constant note-taking only tends to lead the patient to believe that she must be a centre of lively clinical curiosity and study, a belief which we rather want to avoid than inculcate. The practised eye of the physician will readily discriminate the effects which the treatment is producing, and the masseuse should clearly understand that her work is to massage and nothing else. After a short time the patient will look forward with eagerness to the appearance of the masseuse; it is a break to the monotony of the day's proceedings, it is a fresh face which in a measure relieves the weariness of the daily seclusion. Now, with some people, the first effects of massage are to irritate rather than compose and soothe, but in my experience this depends really more upon the masseuse than it does upon the patient. I cannot impress too strongly upon you—though I know I have done this over and over again—that when you first begin to manipulate a patient your movements should be very gentle, and quiet and slow in execution. You must, I am sure, see the necessity for this, for independent of the influence they have upon the sensibility of the patient, the textures will not bear rough handling. Remember you have to deal with wasted, exhausted, feeble, weak and irritable muscles, which, if roughly handled, become still more weak and irritable, and an induced irritability of muscle only leads to an increased irritability of the patient. You might just as well expect good to result by causing a patient to walk immediately upon rising from a severe illness, as to expect a muscle to respond to severe manipulations when weakened and exhausted from prolonged disuse. Therefore for the first week merely effleurage and petrissage in the quietest manner possible. Do not begin passive movements until after the first week; it is astonishing how in some cases you can pass suddenly from the passive to the active. Even with this week's gentle manipulation you will invariably find improvement; the muscles themselves will be firmer, the extremities will be warmer, the skin will have a more healthy feel, there will be less moistness about the hands and feet, and the circulation and temperature of the body generally will have undergone a change. My established rule is never to increase the diet beyond milk and water, beef juice, very thin and crisp dry toast, stewed fruit, cream and butter, until my patient is under the full swing of the massage treatment, which is usually at the second week, when the massage should be combined with passive movements of the limbs for one hour night and morning. The best times are 10 to 11 a.m. and 9 to 10 p.m. You know I particularly advise the lower limbs, the abdomen and the buttocks, for morning massage, and the spine, upper extremities, and head for evening massage. This is my rule, but it has exceptions, and if I do not get the effect I anticipate, I then reverse this order of things and sometimes with advantage; the reason why I cannot tell. The feet and legs to the knee usually require to be manipulated at night as well as in the morning. Above all things do not expose the body of your patient unnecessarily, and maintain by every possible means the gain in temperature which your manipulations have brought about.

Now experience has taught me a great many things of considerable practical value and importance relative to massage, and the chief of these concerns the dosage. I have been led to conclude that massage may be continued for too long a time without getting a corresponding advantage. It is the rule in these cases that it should be continued for six weeks, and this rule is a good one, with very few exceptions, but we occasionally find that in masséeing paralyzed muscles we induce a gain up to a certain point and then its good effects begin to wane. I am, therefore, inclined to think that it is best, whenever this becomes apparent, to discontinue it for a fortnight and then begin again. The muscles and the tissues become too much accustomed to its influence, they seem to be weary of it, and wishful for its discontinuance in order that they may pursue their functions by their own unaided efforts. Or, if it be not absolutely discontinued, its administration should be less frequent, say once, instead of twice a day, and then once every other day. Massage, like everything else, can be overdone, and function is then promoted and sustained by a too artificial means. It should not be discontinued suddenly and entirely; both its commencement and its relinquishment ought to be most carefully regulated.

We consider that a course of massage should be divided into three stages: (1,) A period of gradual increase; (2,) A period of sustained activity; (3,) A period of gradual decline. We say that by the Weir-Mitchell method the third and fourth weeks constitute its period of greatest activity, and at the end of the third week we stimulate the muscles into increased activity by the use of electricity.

Electricity.—We invariably employ faradization. The induced current may, as suggested by Weir Mitchell, be applied with slow interruptions. This may have its advantages, but I am rather doubtful about it. I prefer placing a flat electrode upon the spine, and moving the sponge electrode from one motor point to another. The current must be sufficiently strong to produce good muscular contraction, and independent of this the skin should be stimulated by carrying the sponge quickly over the surface. Of course the current should be weak at first, and certainly not continued sufficiently long to induce fatigue. Half an hour at the utmost once a day is all that is necessary. Dr. Weir Mitchell seems to attach great importance to the value of electricity in increasing the temperature of the body, and in his work on "Fat and Blood, and How to Make Them," he gives some very interesting tables showing incontestably that this is one of its effects. This, however, has long been known, but in some experiments made by myself many years ago quite confirmatory of these results, I found that this rise in temperature was remarkably evanescent, and that in ten or fifteen minutes the register was actually less than before the electricity was applied; and I well remember coming to the conclusion which I now hold, that the rise in temperature was due to nervous excitability, and not, as he concludes, to increased tissue change. But this is beside the point for our consideration. There is no doubt, as we have seen, that muscular contractility is attended with increased metabolism, so that we may fairly conclude that faradization of the body does aid both circulation and nutrition, which may be sufficient to bring about a rise of temperature; therefore I may be wrong, but the gain by the use of faradization in the treatment of these cases appears to me to be the influence which it exerts upon the intrinsic molecular activity of both nerve and muscle, and also of spinal cord. Be very careful, if you please, in the application of electricity never to commence the treatment until the end of the third week, and then do not apply too strong a current, for the injudicious use of electricity may undo all the good which your massage is capable of doing, though its judicious administration is exceedingly useful. I desire, therefore, to put you on your guard. I have proved much by my own experience, and my object in giving these lectures is that you and others who are not too proud to be taught should derive the benefit of this. There are some of these cases which take electricity wonderfully well and with very marked advantage, but there are others who do not. I have some interesting records of these, but in this respect there are no special signs to guide you until you have by its application put it to the test; therefore, as I have just told you, begin with a mild current, and gradually increase its strength.

Before leaving the subject of electricity, I wish to say that

I have in these cases without any doubt obtained excellent results from the combined faradic and galvanic currents used about the fifth week of treatment. I employ a very weak current by means of a strong salt and water foot bath, the positive pole being applied to the nape of the neck, the operation lasting about ten minutes, alternating the current some dozen times. I firmly believe that it aids nutrition more than when the faradic current is used alone. Thus far we have considered some important points in the nature of these cases, their management and their treatment by seclusion, rest, massage and electricity; I have now to draw your attention to dietary, and one or two other matters of no less importance.

Dietary and Therapeutics.—Now this is the most important part of the Weir-Mitchell treatment—inasmuch as it requires the utmost care and judgment in its management. I believe thoroughly in the seclusion for appropriate cases, in massage and electricity, but not in over-feeding for every case. I have records of a large number of instances where I have over-fed and well-fed, and I really think, upon comparison, the well-fed have ended in the most persistent and most permanent cures. Thorough and complete feeding is, of course, in all cases absolutely necessary, but gluttonizing is not essential. The requirements of people for food are extremely variable, and what might be well considered over-feeding in one is really ordinary feeding in another. I might tell you, then, once for all, that I have no definite rules for feeding. I can build up better stuff, and more durable and blood making material, by a diet regulated upon definite lines of requirement according to inherent physical and constitutional tendencies, than I can by maintaining the stereotyped system of over-feeding. To say the least, there are three classes of patients which come under our notice for the Weir-Mitchell cure. The first is the thin, emaciated, bed-ridden, helpless and hopeless invalid. The second is the thin, wiry, anxious, exhausted, but acutely lively invalid, who is constantly aiming to do something, but fails to do anything because she becomes weary and exhausted with any attempt at prolonged effort, and suffers habitually from headaches. The third is the fat, excessively pale invalid, who fails to make blood, whose muscles are flabby, and who is always tired and constantly complaining of weariness and inability to do anything, with sinkings, sighings and yawnings in superabundance. These may be taken as typical of the three classes, but there are no end of sub-classes and species, which I have no time to deal with at present.

Now I have just said that an appropriate dietary for these patients forms a very essential element in the curative process. Let us first consider the dietary for class No. 1, the chronic invalid, the neurasthenic, in whom hysteria may or may not be present. Of course you know we can have suppressed hysteria as well as suppressed gout, the one and the other may be metaphysical as well as physical. But we have to discuss dietary and not metaphysics. I hope that I shall be able to prove to you that we can, in the majority of cases, get better results from good, fair, average feeding than from over-feeding. If we knew more of the secrets of those so-called massage homes, rather than the garbled reports which appear from time to time of exceptional cases with which we are now so familiar, I am inclined to think the gluttonizing modes of procedure would be proved to have met with many failures, as in fact I know that they have.

Every body has a *minimum* and a *maximum* limit with reference to its metabolism, according to the amount of work done by the body and its weight. If less food be given than is necessary to maintain the former, the body loses weight; while if more be given after the maximum limit is reached, *the food so given is not absorbed, but remains as a floating balance, and is given off with the fæces.* When food is liberally supplied and the weight increases, of course the minimum limit rises, hence during the process of "feeding" or "fattening," the income necessary is very much greater than in poorly fed animals for the same increase of the body weight. By continuing the process a condition is at last reached in which the digestive organs are just sufficient to maintain the existing condition, but cannot act so as to admit of new additions being made to the body weight.

The absolute amount of food stuffs required by an adult in twenty-four hours depends upon a variety of conditions. As the food represents the chemical reservoir of potential energy from which the kinetic energy (in its various forms) and the heat of the body are obtained, the absolute amount of food must be increased when the body loses more heat as in winter and when more muscular activity (work) is accomplished. As a general rule, an adult requires daily 130 grammes proteids, 84 grammes fats, 404 grammes carbohydrates (LANDOIS and STIRLING).

I know I shall be told that ordinary physiological estimates are quite out of place in the consideration of these Weir-Mitchell cases, but I am not so sure of this. Anyhow, our aim should be to favour nutrition, healthy metabolic activity, at the lowest expenditure of vital energy on the part of the patient. You must know that milk forms an essential part of the dietary of these patients during the first week; admitted, then, that milk is a typical food and contains all the constituents necessary for maintaining the life and growth of the body, we certainly find that in all cases milk cannot be digested; it may be peptonised with zymine or with Benger's alkaline peptic fluid; it may be taken hot or it may be taken cold; in may be taken in large or it may be taken in small quantity—it will not digest; it creates distension, flatulence and constipation, and cannot be tolerated. It is no use forcing patients under these circumstances to take it. But on the other hand, milk will sometimes agree splendidly, and then it forms an excellent part of the dietary. I make it a rule never to force an excessive diet upon a patient if it engenders indigestion and liver derangement. I have proved the fallacy of this over and over again. Well, if we cannot give pure milk, we try milk that has been skimmed. Weir Mitchell commences in this way by giving daily about two quarts, well skimmed. It is used as Carel directs, cold or warm, not hot, and the amount given is divided so that the patient takes every two hours enough to make up the full share during the waking day. I prefer whey made hot to either milk or skimmed milk, and to every pint of hot whey I add the juice of a lemon.

There is a lady still under my care who commenced treatment three months ago. She was a living skeleton when first she went to bed. After a week of nothing in the way of food but three quarts of whey and lemon juice, and very thin crisp dry toast, well baked, and fresh butter, in the twenty-four hours, I ordered a material alteration in the diet, but she quietly said to me, "Don't you think you had better leave well alone, I feel quite different already, I am sure that I am daily getting stouter and stronger," and upon a careful examination I certainly found that this was the case. The jelly-like feeling of the muscles had given place to something more tangible, and the nurse, the patient, and the doctor were all agreed that the improvement was so definite that nothing should be altered. By the end of the second week, without any addition to the diet, the improvement was not only maintained but increased. The masseuse and nurse were delighted and surprised, and wanted to know where the gain came from. Every function was acting well, the sleep had immensely improved, the tongue was clean, the bowels were acting, the temperature of the body was more natural and equable, the pulse was stronger, and the muscles were developing. The patient was wishful now for a change of diet, but I declined to agree to this, and for three weeks she took nothing but three quarts of whey daily with the lemon juice and a plentiful supply of thin dry toast and any amount of fresh butter.

Now we took a good account of the patient. In the three weeks she had gained eleven pounds in weight, the muscles were firm, with decided tonicity, and during the whole of this time there was no complaint whatever of any form of functional derangement. We still kept to a moderate diet. The first meal, at 7.30, consisted of equal parts immediate tea, milk, dry toast, fresh butter, and the lean of a mutton chop nicely grilled. At 10, half a glass of milk ; at 11, massage as usual for one hour ; at 12, a claret glassful of beef juice ; at 1.30 p.m., slice of mutton, dry toast, fresh butter, stewed fruit and cream, half a tumbler of *hot* whey ; at 4 p.m., half an hour's faradization ; at 5 p.m., a cup of tea and bread and butter ; at 8 p.m., half a dozen oysters and half a tumbler of stout—this was the daily dietary for another week ; still decided improvement. She was now allowed to communicate with her mother by letter only, and to sit up in an arm chair for an hour in the afternoon whilst the electricity was being administered, and thus, with little variation, passed five weeks of treatment, and no case ever did or could do better. We had no hitch from first to last, the patient's condition demanded the treatment which was arranged to adapt itself to the case. For the last, the sixth week of treatment, the patient took three good meals a day with very little farinaceous food stuff. It may seem rather strange that I should object to the hydrocarbons in the form of starch when they are apparently needed, but it is so, and my experience is against them. She took in addition beef juice three times a day, rose at 10 a.m. and went to bed at 7 p.m. Her gain in weight at the end of the sixth week was twenty-three pounds. She returned to the country a different being. She is now under massage treatment for a fortnight, not that she absolutely requires it, for she has more than maintained her strength and weight, but she has adopted it at my special request. I always advise my patients to return if possible one month after treatment for two week's massage ; some do not return, others do, and I feel sure that it is to their advantage to do so.

Now if we analyze this case we shall find in it several points of interest. The first is that from the beginning to the end the patient was not over-fed, in fact from the first by the aid of massage oxidation of tissue was promoted, and a rapid but withal a consistent gain in nutrition was secured. Not one single particle of medicine did this patient take—no iron, alcohol, nor coffee, no cod liver oil, malt extract, nor aloes pill, for you see after a few days I had no functional defect to combat. I gradually promoted functional activity, both in voluntary and involuntary organs, and brought it to a standard of well-defined strength before I gave the digestive apparatus any very especial work to perform. In my past experience I am sure that in some cases I have been unsuccessful from my anxiety to do too much, in fact from over-stuffing. I now act upon and treat every case according to what, in my mind, are its individual requirements. I never hesitate to give my patients alcohol or champagne, or anything, in fact, if I believe they will be the better for it. I have sometimes suddenly changed the masseuse and the nurse with very decided advantage.

Let us now consider the second class of patient: very thin, but withal wiry, anxious, irritable, wanting to have a reason for everything, and exceedingly difficult to please, yet would not be disagreeable for the world, cannot sleep, and full of pains here, there and everywhere. She submits to the treatment to please her husband or somebody else, and she is quite sure that it will do her no good. With this case, you may depend that the nurse will have a lively time of it; still, if you go carefully through the patient's history, you will probably find her friends will tell you that it is only lately she has become so pale, so thin and intractable, and so apparently tired with everything and everybody. I was very much amused with one of my patients of this class, who said she thought there must really be something the matter with her, for her servants, who had been with her a long time, had told her that they could not think what had come over her, as it mattered not how well they did their work, they never gave satisfaction. And this is really the state of affairs. The symptoms usually run in the following sequence: Indigestion, worry, neuralgias, sleeplessness, irritability, even peevishness, pallor, distaste for food and want of appetite, loss of flesh, and a ceaseless activity without any fixed object in view. The age of the patients usually varies from forty to sixty. There is marked defective nutrition of all the tissues, and the mind, in a measure, suffers co-relatively.

Now cases like these require careful handling, for there is no difficulty in curing these people, the trouble consists in getting them to undergo treatment. The two chief points to attend to after the patients have submitted to seclusion, &c., are digestion and sleep. It is unreasonable to believe that they are going to submit at once to extravagant feeding; therefore the dietary should be such as will be easily digested — skim milk or whey with dry toast and butter for the first week; and after the evening's massage, a tumbler of stout may be tried, to induce sleep, and half a dozen or a dozen oysters. You will find that these patients will go on, with many misgivings, until the third week, when they not unfrequently become well nigh unbearable; but get over the third week, and then (such has been my experience) matters improve, and the cure can be accomplished in the ordinary way: at the end of six weeks or two months your patient will be an altered creature, wholesome both in mind and body, calm, quiet, collected, and agreeable, with an entire absence of that fidgety, suspicious manner, which is very characteristic of defective nutrition and impoverished blood.

Let us now take the third class of cases, perhaps the most troublesome of the three to cure. Remember again what I tell you, each class of case is curable by this treatment; but its requirements if not apparent must be sought for; what will cure one person will go a long way to kill another.

The flabby, fat, anæmic patient is frequently the woman who cannot keep anything upon her stomach; she vomits blood, though not very much. There is gastric pain soon after eating, and also upon pressure over the stomach, and she vomits everything she takes; probably for days or weeks together. These people take apparently little or no food, still they keep fat; but are exceedingly pale, good for nothing, too prostrate to do anything, and they do not care to move. There is frequently great pain just before the menstrual period, and the ovaries are exceedingly hyperæsthetic and irritable. These organs are sometimes removed, rarely with any improvement following in the patient's condition. Such invalids try the different Spas, take large quantities of iron, consult the various specialists, and even take an interest in their practice and the patients constituting their *clientèle*. They are generally even tempered, kind hearted and generous in disposition, getting a large amount of sympathy, considering it to be their due. Their age ranges usually from twenty-five to thirty-five.

Fat people, as a rule, are fat because they have relatively less blood. Women with fewer red blood corpuscles are usually fatter than men. The consumption of alcohol favours the conservation of fat in the body; the alcohol is easily oxidized, and thus prevents the fat from being burned up. And in addition to the great size and weight of the body, corpulent people suffer from fatigue and breathlessness, and even apoplexy. The recognised rules for the reduction of corpulency are, not to eat too much, arise from the table with an appetite, avoid sugar, bread, potatoes, and alcohol, drink freely of hot water an hour before each meal, and eat fish and good fresh meat. Tell your cook to throw the frying-pan away, and order fish and flesh, to be taken either grilled, boiled, or roasted.

To treat this class of chronic invalid we have to lessen the fat, and in order to do this we must discontinue any kind of food which increases it; and we must also do everything to improve the quality of the blood. Therefore my plan is to give the patient three quarts of whey daily, with the juice of four lemons, thin dry toast and butter. Fairly active massage is necessary, and can be well borne from the first. It may appear strange to you, no doubt, that I commence to treat these stout patients in the same way that I do lean patients. This is perfectly true, for you must remember what I have told you before about massage, namely, that massage manipulations possess the power to bring tissues into their normal state. If a patient be unduly fat, massage will decrease it; and if the patient be unnaturally lean, massage will promote the growth of fat. Both in the absence and presence of fat we have a train of symptoms somewhat analogous, but an anæmic, fat, flabby patient, is more difficult to cure than an emaciated, bloodless patient, for we have seen that good fat and good blood go hand-in-hand, therefore in our flabby, fat patients we have to create a fresh class of fat altogether.

Then what do we do? We put this jelly-bag-like individual to bed, and for the first fortnight the diet should consist of nothing but whey, lemon juice, and dry toast, or whole meal biscuits; and as soon as possible active massage is commenced. The tissues about the loins, buttocks, and thighs are pressed, kneaded, and compressed in every possible way. Now it is astonishing how rapidly this kind of fat melts. In ten days this fat patient will have lost more than ten pounds in weight, and ten pounds loss of fat will cause the patient to look comparatively thin. The kind of dietary should be as follows: 7.30 a.m., 4 ounces of well grilled steak, cup of weak tea drunk as hot as possible, no sugar or milk; the juice of a lemon may be taken with the tea; 10 a.m., glass of beef juice; 11 a m., massage, particularly of abdomen, buttocks, and thighs; 12 a.m., glass of beef juice; 1.30, two thick grilled mutton cutlets free from fat and bone, dry toast, a glass of good burgundy; 4 p.m., galvanism; 5 p.m., beef juice; 6.30 p.m., beef juice; 7 p.m., boiled sole, dry toast, glass of burgundy; 9 p.m., tumbler of whey with the juice of a lemon; a baked apple without sugar to be taken after each meal.

In these fat anæmic people I always commence treatment with whey and dry toast until a certain reduction in fat has taken place; I then give a relatively small quantity of fluid; no milk or soups; the fluid consisting chiefly of two glasses of good burgundy and sixteen ounces of beef juice in the twenty-four hours. I never give bread, rice, sago, tapioca, or macaroni. Again, in these cases, I rarely refuse either fresh or stewed fruit; and in ordinary cases cream may be taken to the extent of half-a-pound a day.

Perhaps those of you who are familiar with the Weir Mitchell treatment will perceive that I rather lean to very careful, and what I consider *feeding which is especially appropriate to the case*. It is necessary during the course of this cure to take every point of detail into the minutest consideration; this is the only way to meet with uniform success. There is one important point to be considered after the treatment is over, namely, what is best to be done with the patient in order to maintain the gain in strength and flesh? At one time it occurred to me that a sea voyage ought to possess special advantages, but in this I have been deceived. Out of eleven cases during the past twelve months that I have sent to sea after the Weir-Mitchell cure, only seven maintained and improved upon their gain; the remaining four were little, if any, the better for this kind of change.

Lecture VIII.

MASSAGE OF THE CHEST AND ABDOMEN.

Massage of the Chest—Passive Gymnastics of the Chest—Modes of Manipulating the Abdomen — Obesity — Constipation — Scybalæ — Hepatic Congestion and Hypertrophy—Atony and Distension of the Gall-Bladder—Gall-stones—Retained Bile—Ovarian Congestion, Displacement, Irritation, Neuralgia, Hyperæsthesia — Uterine Displacements — Amenorrhœa and Dysmenorrhœa—Neuralgias—Spasmodic Strictures, and Neuroses.

I have to-day to bring in review before you the viscera of the trunk of the body, and endeavour to explain to you the best manner of operating upon these parts for certain forms of disease. I have not much to say to you about the chest, the heart and the lungs contained within it are so thoroughly protected by the framework of this osseo-cartilaginous cage that we are quite unable to affect these structures in any other but an indirect way; still in certain forms of nervous exhaustion, when respiration is defective, and in the first stage of pulmonary disease, and even in some forms of heart trouble, I would especially commend to your notice passive, and even active gymnastic exercises which bring the upper extremities into play and so tend to deeper inspiration and more complete expiration. I have spoken to you concerning what is called internal respiration, when the exchange of gases takes place between the blood in the capillaries of the systemic system and the tissues of the body; respiration by the lungs is known as the outer respiration, which embraces the exchange of gases between the external air and the blood of the respiratory organs, namely, the lungs and skin. The movements of respiration are also important factors in moving the lymph onwards in the pulmonary lymphatics. The movements of the lungs themselves are entirely passive and dependent upon the movements of the chest, therefore you must see the importance of thoracic movements, if the blood is to be duly oxidised, not only for the removal of the carbon from the venous blood, but also to give oxygen to the hæmoglobin to be carried to the tissues for their respiration. Respiration, then, is essential to oxidation, and we know that oxidation is essential to our existence. But I have no intention to weary you with the physiology of respiration. However, let me tell you that in nervous exhaustion and prostration the muscles of respiration frequently fail in their normal work, and when this is the case I always include artificial respiration as part of my system of treatment, and if need be I make my patient inhale oxygen at every third inspiration. The method

I adopt for passive movement is that known as the Sylvester method, and it was introduced by him for restoring life after drowning. I will demonstrate this method to you upon this patient. I place the patient in the horizontal position upon the table with the head and shoulders raised, I then seize the arms just above the elbow and draw them actively over the head (*Fig.* 23). I then flex the arms upon the forearms and bring the arms well into the sides of the chest, using a fair amount of pressure (*Fig.* 24).

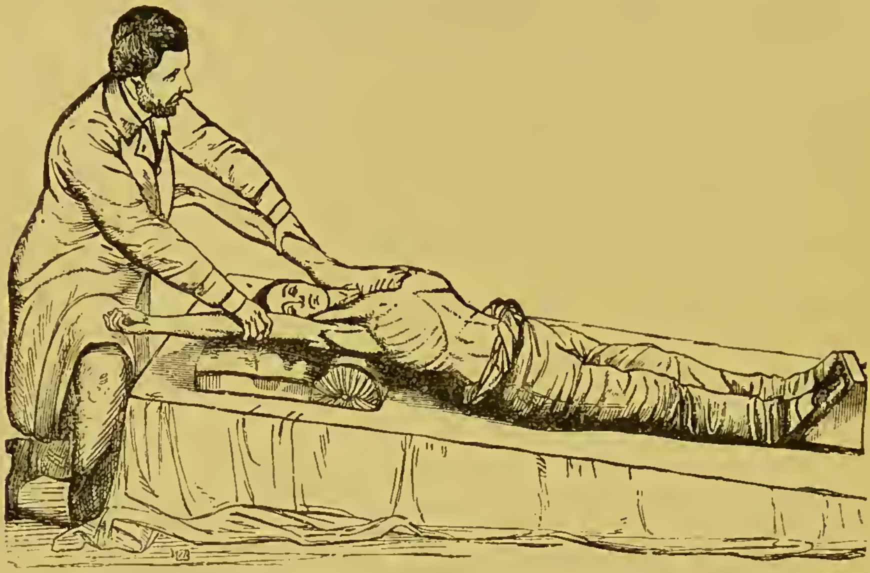

Fig. 23.—Passive Chest Gymnastics for incipient phthisis, neurasthenia, &c.

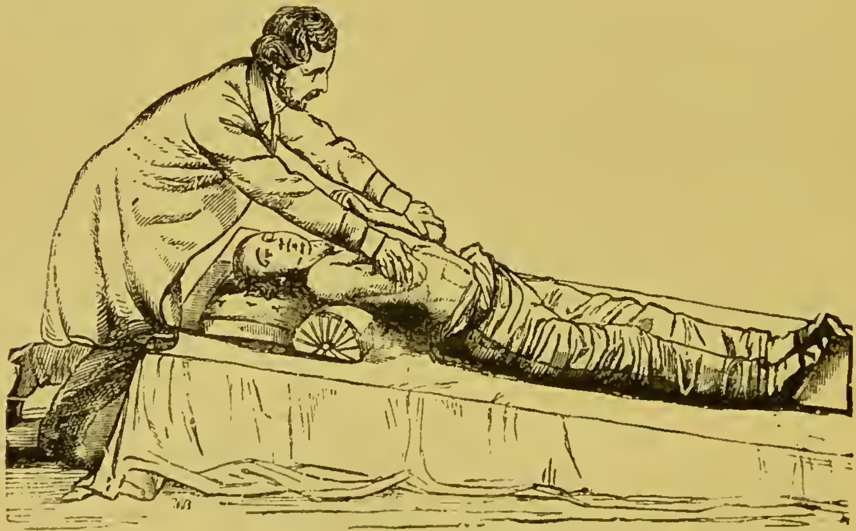

Fig. 24. –Passive Gymnastics for phthisis, neurasthenia, &c.

This passive form of lung gymnastics should be of great service in incipient tuberculosis of the lungs and in pulmonary respiration, my only wonder is that it is not more frequently had recourse to. The skin and muscular tissue over the chest must now be stimulated by progressive petrissage movements from above downwards and outwards, in the course of the ribs.

Abdomen.—You will remember when speaking to you of the anatomy of the abdomen we divided it into nine different regions, each of which was related to the various structures which it contained, or which were to be found in the immediate neighbourhood; but apart from this I must to-day give you some information relative to one or two other points with which I think you ought to be acquainted. To press and pommel the belly is one thing, but to massage with skill and to know the principal structures upon which your movements are being exercised is another.

I will firstly, then, call your attention to massage as applied to the abdomen from a general point of view, and to the intestinal tract for constipation, picking up as we go along some scraps of physiological knowledge, which will, I hope, give us more interest in our work, and offer us some explanation of those changes which we believe result from our manipulations. You know abdomens differ very greatly, some are distended and covered with thick layers of fat, others are without fat, but the recti muscles are hard and rigid, so that it is difficult to relax them. Again, the anterior abdominal wall may be soft and supple so that the posterior wall may be reached without difficulty.

Before manipulating the abdomen, always see that the bladder is empty; this is very important in hysterical cases, for the bladder may be distended above the umbilicus without the patient being conscious of the fact.

Your patient being in the horizontal posture, raise the head and shoulders some six or twelve inches, the thighs must also be raised by placing a pillow or two at the under part, towards the bend of the legs. In order to get the abdominal muscles relaxed, make the patient keep the mouth open and draw up the legs to the trunk as high as possible; but the first is the best position for ordinary massage. Try the sensitiveness of the abdominal muscles to reflex action, which you will always find very variable; in some it will be so active as to produce abnormal movement in the bowel itself. Before commencing to manipulate make pressure upon different parts; firstly, to discover if there is anything abnormal, and, secondly, to find out if there is any tender spot. When massaging for constipation, always smear some lubricant over your hands; there is nothing better than liquid vaseline or castor oil; it is scarcely credible, but upon several occasions I have thought that the use of castor oil in this way increased the tendency to peristalsis.

You now effleurage over the abdominal wall, and remember that all your movements should be in the course of the large bowel, from *right* to *left* of your patient, upwards on the *right* and downwards on the *left*.

Pick up the skin, areolar tissue, and fat by the usual petrissage movements, beginning in the right inguinal region and working round to the left inguinal region. If you have to bring about the absorption of fat, great rolls of fat, you must grasp it firmly in your hands and knead and squeeze it as though it were dough.

Now smear the hands with castor oil and commence the deeper movements, which are in the main mechanical. These manipulations are not easily described, so watch my mode of operating carefully. Let me first say a word or two to you about the colon. This bowel commences in the right iliac fossa in a dilated part called the *cæcum*. It ascends through the right lumbar and hypochondriac regions to the under surface of the liver, it then passes transversely across the abdomen, on the confines of the epigastric and umbilical regions, to the left hypochondriac region, descends through the left lumbar region to the left iliac fossa, when it forms the sigmoid flexure; finally it enters the pelvis and descends along the posterior wall to the anus.

The cæcum is a blind pouch or cul-de-sac, in which the large intestine commences, and in which the lower end of the ilium terminates. Its position in the abdomen is at the inner part of the right iliac fossa, in a line with the middle of Poupart's ligament, and from this point I wish you to begin to operate. You can see the course of the colon in the model before you. Place your two thumbs over

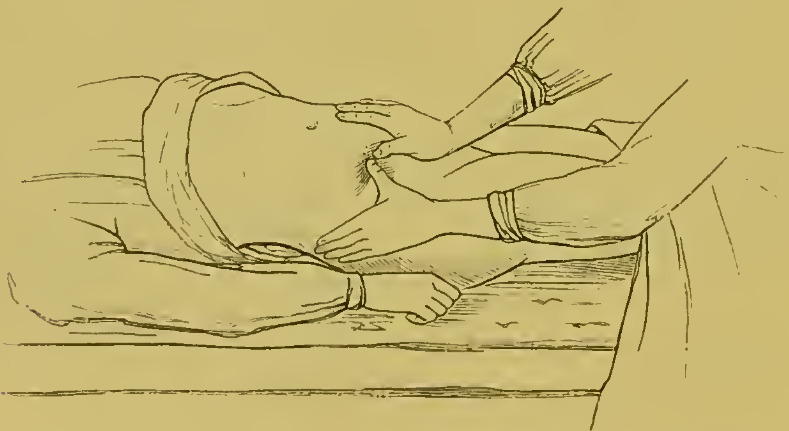

Fig. 25 shows the position of the thumbs and the hands for upward and circular movements in the course of the colon. All movements being directed from right to left.

the *cæcum*, the right hand lying flat upon the abdomen, the left hand lying flat also upon the left side, so (*Fig.* 25). You must proceed upwards by gentle continuous pressure along the course of the ascending colon until you get to the free edge of the right lobe of the liver, but during the progress of this movement the right hand must be exerting a rotatory form of pressure from left to right, in the direction of the transverse and descending colons. When you get to the free edge of the liver, manipulate this part well with your thumbs, for you are immediately over the gall-bladder. After having done so, still press onwards with your two thumbs in the direction of the transverse and descending colon. Remember that these manipulations must be done slowly, purposely, quietly and regularly, never let abdominal massage be done hurriedly or jerkingly. After three minutes operating in this way you make use of a rather more active and general movement with both hands, the inner side of the *left* palm going up the *right* side of the abdomen, and the inner side of the *right* palm descending on the left side of the abdomen ; in this way the small intestines are masséed together, the hands being crossed at the end of each circuit. Another mode by which the large bowel can be satisfactorily, progressively and continuously kneaded, is to work with the tips of the fingers of one hand placed upon those of the other, after this manner. (*Fig.* 26).

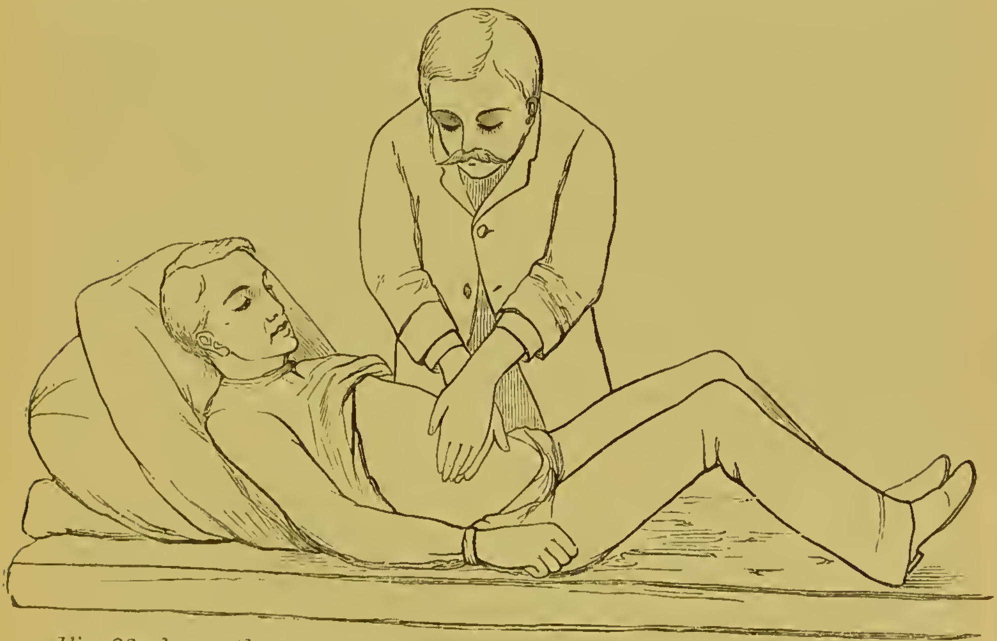

Fig. 26 shows the position of the hands one over the other for pressure movements in the course of the colon.

You know now the special movements which are to be used to the colon, let me show you a particular form of manipulation for kneading the cæcum with the bent hand, in this way (*Fig.* 27). Of course great care must be exercised not to press too heavily, and the pressure should be graduated according to the resistance to be overcome. This portion of the large intestine (the cæcum) from its structural peculiarities and anatomical relations, is more liable to disease than any other part of the large bowel. It may become impacted with fæces, which may harden, forming a painless doughy mass, and very likely at any time to give rise to obstruction, and sometimes to serious obstruction. When this occurs massage in the way just indicated is very useful. The cæcum is not only liable to suffer from the accumulation of fæcal matter, but it is also liable to acute and chronic inflammation. After the acute symptoms have subsided a chronic condition is usually persistent for some months; this is particularly the case when the inflammation has extended to the surrounding cellular tissue. Perityphlitis often gives rise to exudations, which become partially organized, forming large lumps in the right inguinal region and sometimes giving rise to serious discomfort. Massage as I have indicated will disperse these growths, and give tone to the bowels, and also prevent its being the seat of flatulent distension.

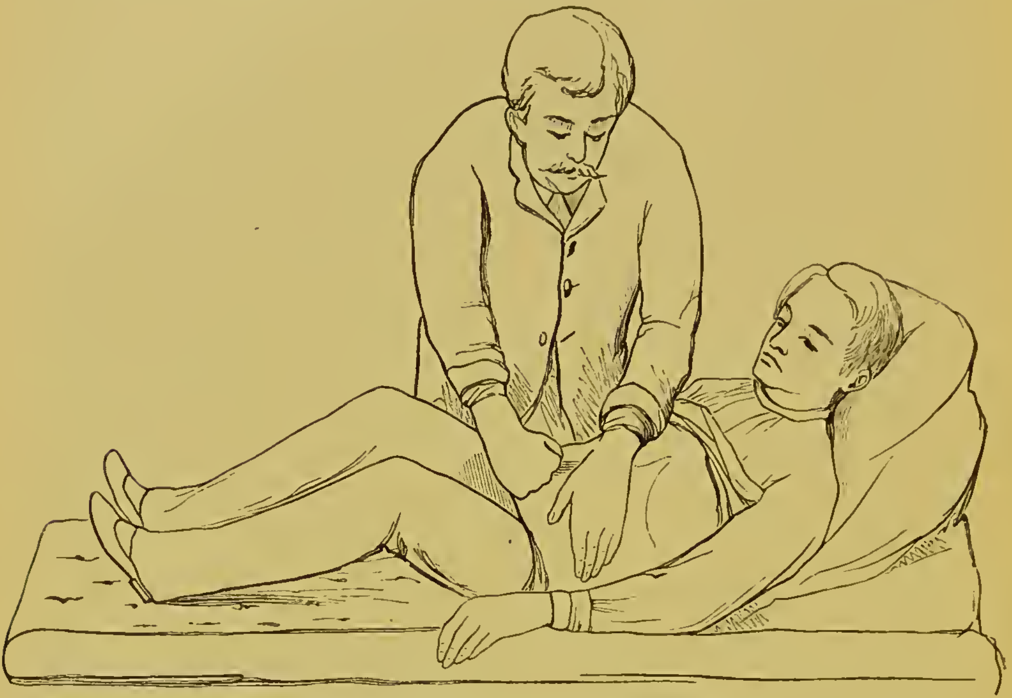

Fig. 27 shows position for carefully and nicely graduated pressure movements in cæcal region in chronic perityphlitis and impaction.

Constipation may be looked upon as one of the most common ills of life, and it is associated with, if it is not the cause of many of those troubles which are known as functional. The contents of the small intestine remain in it about three hours, and in the large intestine about twelve hours. The fæces become formed in the lower part of the large intestine, and pass on to the rectum, where the sensation of requiring to go to stool occurs, that is when their presence is referred to the brain, where there exists an inhibitory centre for the reflex action of the sphincters.

Defæcation should take place once in twenty-four hours, and the bowels from childhood should be habituated to move at early morning. There are some women whose bowels are not moved more than once a week, but this is unnatural and very likely to lead to uterine congestion and misplacements, in fact it is a common source of uterine trouble. Dr. Hughlings Jackson's Nerve Theory of Normal Defæcation is interesting (Dis. of Brain, "Brit. Med. Jour.," July 14th, 1888). He says: "There is a motor (viscero-motor) centre in the medulla, and a controlling (viscero-inhibitory) centre in the dorsal region of the cord. From the former pass polio-enteric fibres by way of the vagus to make the intestines contract, and from the latter leucenteric fibres to keep them dilated, both sets of fibres are fibres of the level extrinsic downwards—both in their short course before their emergence from the medulla and cord and afterwards. But we must suppose that these are intrinsic fibres, fibres in and belonging to the level itself, connecting the two centres, bulbar and dorsal; by these in quiescence there is amicable antagonism between the bulbar and dorsal centres. When the operation of defæcation is started by some afferent impulse, the medulla centre, we shall suppose, inhibits the inhibitory splanchnic centre by the intrinsic fibres, and acts positively by the extrinsic fibres (in the vagus) in the intestine. Thus there is positively forcing and there is negatively yielding." Intestinal movement is known as vermicular or peristaltic, and can certainly be called into increased action (involuntarily) by emotional or mental disturbance. Some people are very sensitive in this direction, worry, fear, dread, pleasure, will often stimulate the bowels to move; the presence of an east wind will with some people give rise to an attack of diarrhœa. The intestinal canal contains an automatic motor nerve centre within its walls which is normally in action during waking hours; *if this centre is not affected by any stimulus the movements of the intestines cease.* "When blood containing the normal amount of blood gases passes through the intestinal blood vessels, the quiet peristaltic movements of health occur (enperistalsis), provided no other stimulus be applied to the intestine. The condition of the blood flowing through the intestinal vessels has a most important effect upon the peristaltic movements" (LANDOIS and STIRLING).

The splanchnic nerve is the sensory nerve of the intestines, and it is also the vaso-motor nerve of all the blood vessels. Intestinal paresis or exhaustion of the intestines arises from over stimulation; this condition is common to such diseases as cholera, septic poisoning, &c., and must not be confounded with *functional inactivity* of the muscles and motor nervous apparatus of the bowel, which is the common cause of constipation. The latter, then, is the condition which we believe we can overcome by massage. I shall leave the consideration of obstinate constipation for my lecture on neurasthenia, because its association with this state of the nervous system is so constant, and the troubles of constipation are so firmly implanted in the minds of neurasthenics, that it really requires special consideration, and it must be dealt with as an abdominal neurose. To sum up, constipation is due to defective peristalsis from, (*a*) Central nervous disease; (*b*) Functional inactivity of the spinal centres; (*c*) An imperfect supply of healthy blood; (*d*) A deficiency of healthy bile; (*e*) The formation of scybala; (*f*) The existence of spasm, pressures, or exudations. It is well for us to remember these, which are the most common causes of constipation. You will much more frequently have to massage the abdomen for blood and nerve and bile defects, than you will for scybala, spasm, pressures, or exudations.

I have spoken and demonstrated to you the ordinary processes of abdominal massage; I have also told you of the common causes of constipation. If the passage of the bowel be partially occluded by cancerous or other growth, massage is useless; but if it be due to scybala, defective blood or bile supply, or defective nerve supply, massage is a good and valuable remedy. I must now tell you that habitual constipation is not so easily cured. I believe in occasional thorough and active purgation; it appears to be very beneficial in many ways, but then the tendency to constipation is not cured, and very frequently after a brisk purge the bowels are more constipated than before. To purge the bowels is an easy task, but to regulate the bowels is difficult. Certainly massage seems to be the best regulator. I do not believe in abdominal massage alone to cure obstinate constipation; occasionally it might have a good effect, but as a rule it will be necessary to massage the spine, back, and buttocks, as well as the bowels; I find this particularly necessary in the constipation associated with ovarian irritation, anæmia, chlorosis, hypochondriasis, &c. Frequently we meet, however, with men and women suffering from constipation which will not yield to any ordinary remedy. These are, for the most part, associated with neurasthenia, and as the nervous prostration becomes cured so the constipation ceases. I am in the habit of ordering these patients the abdominal electric compress, in addition to the abdominal massage. The abdomen is first massaged for twenty minutes with castor oil and the liver succussed and shaken; then the electric compress is prepared and used in the following manner: Fold an ordinary sheet to the width of eighteen or twenty inches, wring it out of cold water (or the water may be hot if the patient cannot bear it cold), and wrap it quickly and tightly around the gastro-hepatic region; then slip between the folds of the sheet a metal plate (6 in. by 4 in.) having an insulated wire attached thereto, this plate must form the anode in the electric circulation; the cathode consisting of a long narrow plate (6 in.) is now applied between the shoulders, the wires from the electrodes are carried above and beyond the patient's head, and connected with the combination currents of the galvanic and faradic elements, the patient's body being well packed in blankets, and if necessary a bottle of hot water is applied to the feet; now turn on a weak combined current (five milliampère galvanic will be quite enough) and sufficient faradic current to be comfortably appreciable. The patient must be kept in the pack for thirty minutes. This is what I call my "Abdominal Electric Compress," and let me tell you that I consider it simply invaluable; it quickens and tones the abdominal circulation, promotes absorption and interchange of gases, stimulates vaso-motor and secretory action, increases peristalsis of the muscle of the intestines, promotes also glycogenesis and the elimination of urea and uric acid. The electrode, which ought to be long enough to extend nearly the whole length of the dorsal vertebræ, should be well padded.

Von Ziemssen speaks very highly of the physiological action of the abdominal compress in the following words. "The blood-warm watery vapour reacts upon the skin and excites the peripheral cutaneous nerves. The warm vapour exercises a powerful dilating stimulation upon the cutaneous vessels, the skin becomes more vascular, and the circulation is accelerated.

"This circulatory acceleration in the skin is not without its effects upon the vascular conditions, in the more deeply situated organs beneath the bandage, and it acts partly derivatively. partly by the moist vapour, which, as we know, penetrates the skin and subcutaneous cellular tissue, and perhaps has effect even at greater depths, exerting an influence over the nutritive processes in the abdominal organs. This would be the local action. But even the original nervous stimulus is conveyed to the central organs of the nervous system, namely the brain, the spinal cord, and the medulla oblongata. The most important vital processes will be influenced by exaltation of innervation through various reflex pathways.

"In irritable conditions of the abdominal organs, the stomach or the intestines, a much higher degree of stimulation is required to set free the action of counter-irritation, and to bring about revulsion by way of reflex. (*This I claim to be effected by the use of the combined current, with which Von Ziemssen appears to be unacquainted.*) The contraction of the skin and its vessels, caused by the cold irritant, diminishes the vascular region of the skin, and elevates the surrounding pressure, and the tension in the vascular region of the internal organs. By the lessening in the amount of vascular space, the obstructions to the circulation are increased, and in consequence thereof also the driving force of the heart. The result of this will be an acceleration of the circulation in the internal organs. When the bandage becomes warm a dilatation of the cutaneous vascular system takes place, and the blood is now driven with greater force into the dilated vessels, which contain little blood on account of the primary contraction, an alteration in the blood distribution takes place, and upon this depends the change in the activity of the organs. The function of the skin is stimulated, and the pathologically increased activity of the abdominal organs is moderated. The primary functional retrostasis in the affected hyperæmic tracts is followed by a reactionary vascular contraction, which forces the blood out of these tracts, and drives it towards dilated cutaneous vessels. Hyperæmia, congestions, catarrhal, and inflammatory phenomena, even in internal organs, may be improved or cured by this very simple procedure." This is Ziemssen's opinion of the value and physiological action of the ordinary cold abdominal compress, which is very interesting, particularly to myself, because by the additional use of the combined electric current, I get more decided and definite results than Ziemssen does by the compress alone.

I have very little doubt that exhausted nerves, by their connection with the semilunar ganglia, together with other important plexuses, are stimulated to increased activity by these means. Of course, if I wish to stimulate the medulla, base of brain, and cervical sympathetic, I either increase the length of my spinal electrode, so that it extends to the occiput, or put the original electrode in the cervico-occipital origin. It is often useful to lessen the resistance of this electrode by saturating it with dilute acetic acid, the galvanic current being slightly reduced in strength. After the operation is over, the body should be quickly rubbed with a towel saturated with a solution of strong sea salt and water for thirty seconds, then briskly rubbed until dry with a coarse hot towel. It is well for the patient to recline and rest for twenty or thirty minutes after he is dressed. In some cases of glycosuria I have by these means reduced the quantity of sugar eliminated from fifteen grains to three grains to the ounce. I have no hesitation in saying that both absorption and secretion go on much more rapidly whilst the patient is in the pack than when he is out of it. Sometimes I make my patient, whilst he is in the pack, swallow through an elastic tube and mouth-piece a pint of hot water (120° F.) with excellent effect, not only in promoting diaphoresis, but diuresis also.

Dr. Fagge reports a case full of interest and instruction in the "Lancet" of July 27th, 1872, entitled "Intestinal obstruction of five days' duration cured by kneading, after injection per rectum." The patient was an adult and a free liver. To the right of the umbilicus and above it, there was distinct hardness, which gave the impression that a transverse coil of the bowel could be felt above, bending on a vertical one below. The vomited matters were brown, with flocculi of a darker colour, but not stercoraceous. Anodynes, hot fomentations, and injections had been thoroughly used, but no relief was obtained until the abdomen was kneaded by the surgeon who attended the case, Mr. Brookhouse, of Deptford. Dr. Fagge remarks that "the life of the patient was saved by kneading the belly, and so satisfactory an issue may well encourage other surgeons to adopt a similar procedure." Yet it cannot be denied that too forcible manipulation of the abdomen might in many instances involve great risk of tearing through parts softened by inflammation or sloughing, and thus counteract the curative processes of nature. Massage in 1872 was different to the massage of 1888. Practice and experience cannot fail to have given us a better insight into the various modes and degrees of manipulation, which are necessary and suitable to different cases under varying conditions. No doubt some of you remember that when massaging Mrs. W—'s abdomen, you pointed out to me two distinct and separate, irregular, hard lumps; one was in the ascending colon just above the cæcum, the other was in the descending colon not far from the sigmoid flexure. I told you that, in my opinion, they were hardened masses of fæcal matter (scybala), and that massage would soon remove them altogether; this turned out to be true, for in three weeks not a trace of them remained.

There are many cases reported in the German medical papers of the use of massage in intussusception, all ending in recovery; but in the literature of this country we find very little relative to this subject. No one should attempt to massage the abdomen in suspected cases of intussusception, unless they were not only skilled in massage, but also knew precisely what the movements were likely to effect, and what they were expected to effect. Doubtless a great deal of harm might be done by rough, indefinite, misplaced manipulations.

Mr. Warrington Haward, in a very excellent article, on "Surgical Aspects of Constipation," in the "Lancet" for April 28th, 1888, to which I shall have to refer again when speaking of the diseases of advanced life, gives the following case, with some remarks which may interest you: "A young lady of nineteen, the sister of one of our pupils, was brought to me on account of a lateral curvature of the spine. There was a slight curve, the convexity in the lumbar region being to the left. The patient complained much of a dull pain in the loins, especially on the left side. She stooped a good deal, and was very easily fatigued. She was, moreover, extremely thin and anæmic, had but little appetite, a coated tongue, foul breath, and very cold hands and feet. An examination of the abdomen revealed a large fæcal accumulation in the sigmoid flexure; and on being questioned, she admitted that the bowels were extremely constipated, often acting only once a week.

This is one case out of a series of the same kind that has come under my notice, in which a supposed lateral curvature is merely the habitual position assumed by young girls suffering from obstinate constipation and loaded sigmoid flexure." "Such cases," Mr. Haward goes on to say, "are best treated by massage, feeding and aperients, under which the anæmia disappears, the bowels recover their power, appetite is regained, flesh is made, *and the yielding of the spine comes to an end.*"

Obesity and Corpulence.—I do not think I can do better than bring the subject of obesity before you in this lecture. It means disease, and in somes cases it forebodes a serious termination; it certainly indicates an excessive deposit of fat in the connective tissue structures of the body; it is, as you know, invariably associated with excessive corpulence, and is more common amongst females than males. Weir Mitchell speaks of different kinds of fat, and unquestionably there are fats and fats. You know my opinion about the absorption and dispersion of fat by massage; it is simply this: If a woman becomes fat, who should be so naturally and by heredity, it will take a vast deal of massage to make her thin and give her that lightness and grace, for which she so vainly sighs. On the other hand, if a woman rapidly puts on fat to which she is not entitled, on account of some change in diet or mode of living or time of life, or some freak of nature, the absorption and dispersion of this kind of fat is by no means a difficult matter. Ladies of the Semitic race are frequently predisposed to the development of adipose tissue and corpulency; the fat is usually bad stuff, and these subjects not unfrequently suffer from glycosuria, of which they are ignorant; they are, as well, often pale, and bad oxygen carriers. Now these are the patients upon whom, with hygiene and appropriate diet, massage has such wonderful power in the dissolution of fat and the inhibition of certain fat making agents in the nervous system. Excessive fat means a perversion of the normal nutritive processes, and it is extraordinary what a small amount of food is sometimes consumed by fat people, and what a large amount of food may be taken by leanly disposed people without giving rise to a particle of fat. Fat people are, on the average, of shorter lives than lean people. No means should be neglected or pains spared to diminish excessive fat. The remedy is unquestionably to be found in massage, exercise, diet, and hot water.

I was called to see a lady some few weeks since who was remarkably stout. She told me that she was equally thin previous to two months' Weir-Mitchell treatment, which she went through last summer. During the treatment the increase in weight was nothing remarkable, but ever since she had grown stouter and stouter: how far this means a perversion of nutrition remains to be seen; at the present time her limbs are quite firm.

Many people have tried the Banting system, with the same success as Banting himself, who lost by dietary alone in one year forty-four pounds in weight, and without the recurrence of corpulence when the ordinary diet was resumed. Others have tried it with very baneful results, for just as they lost weight so they got so miserably out of health that they have been glad to resume their ordinary diet in order to get fat again.

You have had opportunities here of seeing fat people lose fat and lean people gain fat. The alteration in weight from the effects of massage is always of great interest, therefore I am at all times very careful to take the height and weight of my patients before and after a course of massage; also their muscular power and breathing capacity, and their resisting power to both the faradic and galvanic currents.

I may not possibly have an opportunity of referring to this matter again, therefore I will say now all I care to say about it. A certain amount of fat is, or appears to be, necessary to a healthy existence and to a normal condition of the blood. Rapid thinning is accompanied with more or less anæmia, and, as Weir Mitchell says, the blood thins with the decrease of the tissues, and enriches as they increase. The loss of fat, especially its rapid or steady loss, nearly always goes along with conditions which impoverish the blood, and, on the other hand, the gain of fat up to a certain point, seems to go hand-in-hand with a rise in all other essentials of health, and notably with an improvement in the colour and amount of the red corpuscles. On the other hand, we often see people between fifty and sixty putting on fat rapidly and suddenly, and becoming at once unwieldy and feeble; the fat collecting in masses about the belly and around the joints. Such an increase is usually accompanied with fatty degeneration of the heart and muscles, and with a certain watery flabbiness in the limbs which, however, do not pit on pressure. Obesity with thin blood, says Weir Mitchell, is one of the most unmanageable conditions I know of. And this I have certainly proved before I adopted the massage treatment.

Setting aside fat as a disease, and dealing with it as we frequently do, in persons who are called stout with a tendency to corpulency, it must be a comfort to them to know that with ordinary attention to diet, and general massage once a day for three or four weeks, they can be greatly reduced in weight, and improved in health at the same time.

There are, of course, some people in this world who cannot be anything but inactive, who will not exercise their muscles although they have every opportunity, they drive about from place to place, and enjoy the pleasures of the table to their heart's content. Again, there are people who by occupation are unable to take that amount of exercise which is necessary for a healthy existence. In each case massage must be very useful in promoting tissue changes, increasing nutrition and keeping secretion and excretion, repair and waste at a normal and natural level. Massage is truly a factor of energy, and the best tonic known.

The Liver is one of the most important and the largest glandular organ in the body. Its chief function is to secrete bile which flows into the *gall-bladder*, so that in masséeing this organ we must not forget to manipulate the gall-bladder. It is true that one important function of the liver is to form and stir up glycogen, which is eventually useful in evolving heat and muscular energy. There is another point for us to remember, that the liver receives from the *intestinal circulation* poisonous substances, such as peptones and ptomaines, and thus prevents their entering the *general circulation* unchanged. Dr. Brunton says, "The liver acts as a porter or door-keeper to the circulation, all the substances which are absorbed from the intestinal canal having to pass through the portal vein and the capillaries of the liver before they can enter the general circulation." The functional activity of the liver is very important to health, and derangement of this organ means constipation, indigestion, and a whole train of troublesome symptoms, so that the stomach, the liver and the intestinal tract are of necessity immediately associated in the processes of digestion and assimilation, and it would be useless to massage the intestines without including the liver, and *vice versa.* Functional derangement, then, gives rise to partial arrest of secretion of bile, and to its excretion when secreted. The terms torpid and inactive are very appropriate, and there can be little doubt that the liver is frequently torpid and inactive, and it then refuses to perform its biliary and glycogenic functions.

The whole of the chylopoetic viscera sympathises with this inactivity, and the general circulation becomes impregnated with poisonous and effete material, giving rise to acidity, flatulence, furred tongue, headache, nausea, loss of appetite, prostration, hypochondriasis, languor, slow pulse, and loaded urine of high specific gravity. In plain words, there is a general arrest in the normal functional activity of the nervous circulatory, secretive, excretive and assimilative processes of every organ in the abdominal cavity, and possibly outside it as well. This inactivity of the liver may be due to the nervous system as a cause, to overwork, anxiety and worry, to shock, to sudden depressing influences, to overfeeding, and not unfrequently to over-drinking and smoking, cold or excessive heat. If the liver is too long inactive from drink as a cause, and if the presence of such an exciting agent be maintained, the result is vaso-motor paresis and enlargement, interlobular exudation, connective tissue proliferation, and, finally, contraction. Now we believe that if massage be adopted early enough we can, and do, arrest degenerative change.

Again, we talk of a torpid liver as functionally deranged. In some people, possibly those of a bilious temperament, the liver is exceedingly liable to derangement; it becomes oversensitive and gets into bad habits; we know that drugs are of some use in such conditions, but they are often given to relieve symptoms, rather than to bring the liver to its normal tonus and standard power of resistance; no better proof of the truth of the assertion is to be found than in the large number of people who are taking bilious medicines all their lives. We claim for abdominal, gastric, and hepatic massage that it will do what medicine fails frequently in doing.

The movements of the diaphragm assist very greatly in aiding the expulsion of bile from the liver; this they do in ordinary respiration, but their effect is much greater in extraordinary or forced inspiration. Exercise which increases respiratory movements acts as a mechano-therapeutic agent upon this organ. There cannot possibly be any better exercise than rowing to induce pressure upon the liver and squeeze out its contents. Of all forms of exercise I maintain that rowing is the best, and it is accomplished with less expenditure of energy than any other form of exercise with which I am acquainted, therefore I consider it of essential value in neurasthenia.

I have often shown you the best way to work at the liver. In my experience I have found it exceedingly difficult and in some cases absolutely impossible to work into the substance of this organ. I have demonstrated to you what an almost hopeless task this is, unless the organ is very much enlarged,—of course, when this is the case there is nothing between the free surface of the liver which is enlarged and the abdominal wall, so that you can actually pick up the margin of the liver and pinch and knead it, but even this is not easily done. There are two positions in which to place your patient; the first is that just described for abdominal massage, with the thighs and thorax well raised. I prefer this position both for acting upon the liver and the gall-bladder. I place the palm of my *left* hand firmly upon the ribs in the *left* hypochondrium, and the palm of my *right* hand firmly upon the ribs in the *right* hypochondrium, making the left hand a fixed point by its steady continuous pressure upon the ribs. I now produce with the heel of my right hand a series of pressure and relaxation movements over the liver, exercising a fair amount of force. I make my pressure synchronous in time with each inspiration, but what is better still I ask my patient to breathe by extra-inspiratory efforts, and then use pressure just at the pause between inspiration and expiration, relaxing the pressure at expiration. This action upon the liver is percussive, concussive and succussive, and does more to stimulate the liver to excrete its bile than any other process with which I am acquainted. These movements must be continued for five or six minutes, and I must not forget to show you that the pressure must sometimes be applied by rapid, jerking, vibratory action of the arm. It requires a little practice, but if it be well done it positively shakes the liver. We now turn the patient upon the belly, and we map out carefully the exact position of the mass of the liver, from the fifth or six rib downwards, and here we use tapotement movements freely and thoroughly. Sometimes I petrissage the skin very carefully over the hepatic region and use intercostal pressure with my thumbs, in this way, but I rely more upon the percussive action which I have just shown you. Some authorities think it better to have the patient in the sitting posture, resting upon the elbows with the body inclining forward, as it is said to relax the abdominal walls and allow the liver to gravitate downwards and forwards. I do not deny that this position may be a good one. I never adopt it; firstly, because the position of the patient is an inconvenient one for the operator, and, secondly, because it is generally admitted that in the upright and sitting posture the liver usually recedes behind the ribs. If you have to massage the liver specially you must not do so after a full meal; two or three hours should have elapsed. The best time is when the chyme is passing into the duodenum, *when in fact the chyle function is in full operation and the gall-bladder and pancreas are in a state of activity.* The position of the liver, it must be remembered, varies according to the greater or less distension of the stomach and intestines; when the intestines are empty the liver descends in the abdomen, but when they are distended it is pushed upwards. At every meal there is an increased flow of blood to the liver and also to the stomach.

I am particularly anxious to tell you as much as I can reasonably, from the massage point of view, about the liver, because in functional abdominal disease this organ and the gall-bladder are not unfrequently primarily at fault, and abdominal massage can never be complete without the liver receiving its due share of attention. "Hepatic affections," says Dr. Roberts, in Quain's Dictionary of Medicine, "by interfering more or less with the physiological functions or anatomical arrangements of the organ, may give rise to diverse phenomena, not only of a local character, but associated also with the general system." Functional hepatic disorders are regarded by many eminent physicians as being of peculiar significance, and as demanding special attention, particularly with reference to those derangements which influence the secretion of bile, and likewise I might add the expulsion of bile. Then, I maintain that by massage, local and abdominal, we find a cholagogue of definite value; if we want an hepatic stimulant we use the electric abdominal compress as well. You must again allow me to state that I never forget to administer drugs when I believe they may prove advantageous, but the cases which often come under our care are those where drugs have been tried and tried in vain. Still, drugs without massage may in functional affections of the liver prove useless, but (and I am speaking from experience) they may be of greater utility when used with massage.

The gall-bladder is the reservoir for the bile; it is to be found in a fairly direct line with the curve of the ascending and transverse portion of the colon, behind the ninth costal cartilage. In operating upon the ascending colon you will remember that I particularly impressed upon you that when you reached the ribs you were in the immediate neighbourhood of the gall-bladder, and that here you made a halt and worked by deep petrissage over this viscus. You must know that it is now a common operation to cut down upon the gall-bladder and remove gall-stones from its interior, and also from the common duct; but from what I have heard of these operations, that is from cases which have been brought forward at the medical societies, I am of opinion that obstructions in the common duct can be removed by massage quite as well as by operation, without the great risk of losing life. But I shall say nothing more of this. I must call your attention, however, to several points in connection with this gall-bladder and the bile it naturally holds, which, in my opinion, are of very great importance, for I believe that the liver not unfrequently gets blamed when the gall-bladder is actually at fault. The bile under normal conditions is continually being secreted by the liver cells, and is stored up in the gall-bladder, and it should have a very definite composition, but this for many reasons is variable. It is poured out copiously into the duodenum when the chyme distends this portion of the intestine, but demand and supply should be equally balanced, which is not always the case. If the bile-ducts become occluded by catarrh, spasm or calculi the bile stagnates, becomes viscid and thick, and refuses to flow through the natural outlets; then the gall-bladder becomes distended, sometimes so great is the distension that its walls are completely paralyzed, and the smooth muscles when stimulated by the spinal nerves cannot contract, although they endeavour spasmodically to do so, hence the pain which so frequently attends this condition. The bile, under these circumstances, is reabsorbed and carried into the circulation, giving rise to jaundice, and a very unwholesome train of symptoms frequently follow, chiefly of a dyspeptic, acid and flatulent character. The fæces become clay coloured, fatty material passes through the intestines undigested, and the bowels are constipated owing to the hardness of the fæces and to the absence of peristalsis, due to deficiency of bile. Bile pigments pass into the urine, and give to it a characteristic deep brown colour.

Spasm of the bile-ducts and paralysis of the gall-bladder, partial or complete, is much more frequent than is usually supposed; it is not always attended with pain, neither is it associated with dyspepsia, although these symptoms are frequently present, and in some instances they are exceedingly distressing. Worry, anxiety, and shock, which give rise to persistent depression of spirits, are most frequently the cause, far more frequently than cold or over-eating or drinking, yet the latter are sometimes factors. These conditions of the gall-bladder and gall-ducts are sometimes very difficult to relieve by medicine, they are very liable to recur even after the patient is supposed to be cured. I have no hesitation in saying that massage and the electric abdominal compress are the curative agents for spasm and catarrh of the bile-ducts, atony of the gall-bladder, and inspissated bile.

Chronic Dyspepsia is a name given to various alterations associated with the stomach and intestinal tract; it may be catarrhal, congestive, neurosal, fermentative, glandular, and so on. It is frequently accompanied with great irregularity and variability of the bowels, constipation and diarrhœa alternating with each other, but constipation usually predominating. Sometimes pain is felt in the stomach like a lump of lead immediately after taking food, or there is a strange feeling of *sinking* and *want* in the bowels; occasionally the bowels become greatly distended, and acid flatulence and colic are then very troublesome symptoms. At times this form of indigestion is attended with melancholy (hypochondriasis), and here, again, I say abdominal massage and galvanism are the remedies.

Disease and Derangements of the Pelvic Viscera.—The organs of the pelvis which we have to consider more particularly are the *uterus* and the *ovaries*. Let us deal with the uterus first. The womb, you know, is a pear-shaped body, suspended by ligamentous structures. It is freely moveable, and on this account is liable to *displacement;* a loaded rectum will exercise pressure upon it from above and behind, and a distended bladder from below and in front. From the massage point of view only, it seems to me necessary that we should know something of the common ailments of this organ. It is composed chiefly of muscular tissue which is plentifully supplied with blood vessels, lymphatics and nerves. It is capable of great changes, chiefly at the menstrual period, and, secondly, at the period of gestation. The upper part of the uterus is called the fundus, which is in direct communication with the ovaries by the Fallopian tubes, the lower part is called the cervix terminating in an aperture known as the os with its labiæ. In difficult menstruation the channel through the cervix is contracted so that the menstrual fluid escapes tardily, accompanied with great pain; this contraction is often spasmodic and unrelieved by incision or even dilatation.

Dysmenorrhœa, as it is called, or mechanical dysmenorrhœa, is usually accompanied with lassitude, languor, backache, and headache, and in some cases there is every reason to believe that the difficulty of exit of the fluid is dependent upon blood clots and masses of mucous débris, which choke up the passage and so bring about retention. This is no doubt a frequent cause of dysmenorrhœa, otherwise incising and dilating the cervix should bring about relief, which it does not always do. If there be congestion or sub-acute inflammation of the uterus, the pain extends over the pelvis, and excites general irritability and over-sensitiveness of the pelvic nerves, which may extend to the buttocks and the thighs. Reflex irritation set up in this way may be accompanied with vomiting, hysteria, and delirium. Pain usually comes on before the discharge makes its appearance, sometimes a few hours after. It is admitted that dysmenorrhœa is a most troublesome and obstinate condition, and one which sometimes does not yield to any form of treatment. The usual remedies are dilatation or incision of the constriction, attention to the general health, rest, hot baths, and anodynes.

I was first struck with the value of massage in dysmenorrhœa some seven years ago, in the case of a lady about thirty-five years of age, who was undergoing a course of treatment for nervousness. After it was over she expressed her astonishment and pleasure at the beneficial influence it had exercised over the menstrual flow. For years it had been accompanied with difficulty and great pain, and she had undergone several severe operations, but on the last two occasions there had been no pain whatever. Her feelings of surprise, satisfaction and delight were immeasurable, because, as she said, she never expected any freedom from what she termed her monthly period of agony and distress. In this case the lady was having general massage, including, of course, abdominal, but no special uterine or ovarian massage of any kind was used. No one can doubt, who has had experience, as I have had, in the treatment of dysmenorrhœa by massage and faradic massage, that it has a very specific influence over all uterine function, and I may say especially over the function of the ovaries. What is good for the one is unquestionably good for both. I assure you I have no wish whatever to interfere with the gynæcologist, for if I have the slightest doubt about the state of the uterus or its appendages I always seek his opinion prior to commencing a course of massage or electric treatment.

Before speaking to you of displacements of the uterus, I must call your attention to the value of massage and the combined electric current as emmenagogues in some forms of amenorrhœa. My mode of applying galvanism in these cases is by means of the hot salt and water foot-bath, connecting the bath with the negative pole of the battery, the positive sponge electrode being applied to the hypogastric region. The patient places the feet in the bath for about ten to fifteen minutes, and a current of from ten to twelve milliampères is administered at each sitting; this form of galvanic foot-bath may be used every other day, but abdominal and spinal massage should be applied every morning for about twenty minutes. The hot salt water foot-bath, independent of the galvanic current, "causes dilatation of the arteries of the legs, and it is probable that this dilatation extends up the iliac vessels, so that more blood may be sent to the genitals by this means. In addition, however, it is probable that a close nervous connection exists between the vascular supply of the uterus and the feet, for we know that hot mustard foot-baths promote menstruation, whilst, on the other hand, cold to the feet retards it. I need scarcely say that this is worth knowing and remembering, for absence of menstruation is associated with, if it is not the cause of, some of the most troublesome forms of disease with which young life is afflicted. Sometimes drugs act very satisfactorily, at other times they seem to be quite ineffectual. Please to remember, however, that massage and galvanism are intended to improve nutrition and restore or generate function, and there is no reason whatever against this treatment being supplemented by the administration of emmenagogues. The cases which come under our care, however, are generally those upon whom all other forms of treatment have been tried and have failed, therefore the success is all the more pleasing and instructive. The uterus is particularly liable to congestions, or congestive inflammatory changes. I have not had any large experience of the effect of massage in these conditions, yet they form an important class of women's diseases, and I must therefore call your attention to them.

There are authorities upon massage who speak very highly of manipulations in bringing about absorption of exudations in chronic endo- and para-metritis. Dr. Graham is one of these authorities. Chapter VI. in his "Practical Treatise on Massage," has the following heading : "Massage of the uterus and its surroundings, with a report of two hundred and thirty-nine cases," so, if you please, I shall take Dr. Graham as my authority in all that I have to say to you in reference to the treatment of chronic congestive inflammatory changes of the womb and its surroundings.

"Massage of the pelvic organs should be intrusted to those alone who have 'clean hands and a pure heart,' and such a thorough knowledge of the pathology and treatment of uterine affections as is possessed by the most accomplished gynæcologists. It should not be confided to any professional manipulator, however skilful. Credit is given to Major Thur Brandt, a Swedish gymnast, for having been the first to use massage in the local treatment of uterine affections, about ten years ago, in 1874. His method excited much adverse criticism, which, however, has passed away, as the excellent results obtained became better known. In the hands of a layman it was, doubtless, at first used without proper discrimination, and extravagant results were obtained. The next to interest himself in this was a physician, Dr. Gustaf Norström, of Stockholm, who used the treatment rationally and in cases that he could understand. He found massage especially successful in chronic metritis that had not arrived at the period of induration, and after this in the affection known as hæmorrhagic endo-metritis. He also obtained good results in prolapse of the vagina and in chronic inflammations of the ovary. The catamenia, acute and sub-acute affections, and pregnancy are contra-indications. In his report of 1876 is given his experience, which extended over two years and a half, and which shows that in 138 cases of chronic metritis he obtained forty-three complete cures, and more than seventy nearly complete. Nine cases of hæmorrhagic metritis were cured, and in seven cases of sterility, complicating chronic metritis, there occurred conception in two soon after the cure had been effected.

"The operation consists in introducing an index finger into the cul-de-sac behind the cervix, in such a manner that the posterior surface of the uterus is reached. This is then raised as far as possible, while the fingers of the other hand grasp and knead the uterus through the abdominal walls. Sometimes the uterus is pressed against the walls of the pelvis laterally or against the posterior surface of the symphysis pubis. Massage acts in these cases by removing and preventing the inflammatory stasis, by producing resorption of leucocytes and elements which have migrated into the surrounding tissue, and by restoring tonicity to the tissues. Dr. Jackson, of Chicago, who seems to have had great experience in this form of massage, says, 'Not every case of uterine enlargement is amenable to squeezing and kneading, in some it might be injurious. Massage is available in the first stage, when the uterus is found low down in the pelvis, enlarged, tender, and spongy, and having a doughy elasticity, its sinuses gorged with blood, and newly formed connective tissue in its walls. If the first or hyperæmic stage is passed, and the organ has become firm and indurated like cartilage, massage and all other remedies will be useless.' The author makes a noteworthy distinction in pointing out the fact that the pains and discomfort accompanying enlargement of the uterus are really seated in the walls of the abdomen, though usually referred to the uterus; and these are first subjected to massage, gently and superficially to begin with, then more deeply and vigorously, until sensitiveness lessens sufficiently to allow the uterus to be kneaded. If this cannot be done effectually through the abdominal walls, the first and second fingers should be passed into the space behind the vaginal portion which is pulled gently forward, and then permitted to return to its former position. This is repeated half a dozen times or more, when the fingers are pushed higher up so as to reach the supra-vaginal portion of the cervix and lower part of the body. The upper part of the uterus being now steadied by the hand on the outside, it is pressed between the fingers of both hands repeatedly for a few seconds at a time and then relaxed. Every portion of the organ which can be reached should be subjected to these momentary squeezings. Then the manipulations should be reversed. The intra-vaginal fingers should be drawn in front of the cervix, and the latter pushed backwards several times, as far as possible short of causing pain. Then their ends being passed between the bladder and the cervix, and their pulps turned against the latter, the fingers of the outside hand should be so adapted that the exterior body may again be brought between the compressing forces, when the squeezing and imparted movements are to be repeated as before. Alternating with the process described, the uterus should be frequently elevated on the pelvis, and held for a few seconds.

"Dr. Otto Bunge, of Berlin, has published an article reporting favourable results from massage of the abdomen. He has used massage most frequently for the removal of the sequelæ of peri-uterine cellulitis and pelvic peritonitis of the most various forms, which had bade defiance to the customary methods of treatment. His mode of using massage was very much similar to that of Norström and Jackson; but as his aim was often the loosening of adhesions and the dispersion of indurations, the manipulations in such cases were directed towards the seat of these, working more around the uterus, internally and externally, and pushing, pulling, or raising it in such ways as would detach the adhesions. The good effects of this treatment showed themselves by the dispersion of the pathological products, thus increasing their surface for reabsorption by furthering the circulation and by stirring up the contractions of the uterus. Cases were treated in which the uterus was so closely fixed to one or the other part of the pelvic walls by adhesions, that at first it was not possible to penetrate between them: with these only gentle, steady pulling or pressure could be used; but by patience and perseverance they became the most thankful of all cases." Dr. Graham then gives the tables of Dr. Bunge's cases.

Now I have quoted thus largely from Dr. Graham's book because the subject is one with which I am not familiar, and I have had no practice in this mode of operating. Neither am I going to question the necessity for intra-vaginal manipulations. I do not think they are necessary, otherwise than in exceptional cases. I will now call your attention to mechanical displacement of the uterus, and to my mode of manipulation in order to put this organ right. If you think for one moment how the uterus is suspended, so to speak, in the pelvic cavity, pressed upon from behind by a loaded rectum, and from before by a distended bladder, and how liable it is to become *top heavy* from congestion of the fundus and from growths of an adventitious kind inside its cavity and within its walls, the only wonder is that the uterus is ever just where it should be. If compensation in the human tissues did not exercise itself to remedy to some degree the physiological disturbances in the animal economy due to the modern habits of so-called civilization, I am afraid the poor little uterus would be constantly sky-larking from one part of the pelvis to the other. There is no organ in the body so liable to displacement, but nature has in her best way arranged for this; and if we consider the function of the uterus in regard to gestation, the necessity for absolute mobility is at once apparent. There are no physiological processes in the body to be compared with the marvellous workings of the uterus and ovaries in fecundation and gestation. There can be little doubt that uterine congestions with some amount of displacement are as common as piles; and to some women the one is as great a source of annoyance and discomfort as the other. Nor can we wonder at this. Just imagine for one moment the uterus of a young lady of a somewhat lax habit of body, not fond of exercise, the waist imprisoned in a tight corset, the feet squeezed by sheer effort into a pair of tight boots, with the calls of nature utterly neglected, the bowels relieved possibly once in a week or ten days; the result is uterine derangement and displacement, the sexual organs must suffer, the ligaments fail to duly antagonize each other, they yield for want of tone, and prolapse and displacement must of necessity result. The great question to my mind is this, Do slight displacements require the constant use of pessaries? Is it well to concentrate a woman's mind too much upon this part of her organization? I am inclined to think to the contrary. I would neither massage nor support a uterus unless I were quite sure that the displacement was of such a nature that some kind of operative procedure was absolutely necessary. Meddlesome local uterine medication is, to my way of thinking, not only unjustifiable, but unpardonable.

Dr. Playfair divides displacements into two classes, "*versions* and *flexions*. In the former, the body of the uterus retains its normal shape, but not its normal direction, the entire organ being displaced either forwards, backwards, or to one side; in the latter the shape of the uterus is altered, and its body is more or less acutely bent over the cervix in the form of a retort."

Now you know I have told you more than once that massage does possess the therapeutic power of going so far and no farther; of doing much work that cannot well be undone, by merely aiding nature to repair errors of omission as well as of commission. If your manipulations are exercised with just sufficient excitation, force and pressure, the tendency, and the one tendency only, is to bring parts to their normal, anatomical, and physiological status. In righting a displaced or flexed uterus we not only have to consider the condition of this organ, but we must also make ourselves acquainted with the nature of its environment, and its blood and nerve supply. Setting aside all indirect causes, we must conclude that a loaded rectum, and a retarded circulation through the abdominal veins, leading to a plethora of the abdominal viscera, are common factors of maltaxis of the womb, therefore I hold that local and general abdominal massage should be, and is a most efficient and permanent remedy.

Let me now direct your attention to the manipulative processes. In the first place you perform general abdominal massage after the manner and according to the rules which I laid down at the beginning of these lectures, stimulate every part of the abdomen from the skin to the deeper parts, then place both your hands flat upon the ilio-hypogastric regions (first make sure that the bladder is empty), pinch up the skin and underlying fat, so as to gauge its thickness and the amount of pressure required to get beneath the abdominal muscles, which must be relaxed to their fullest extent; your movements must be lateral and impressive. Standing as I am now, to the right of my patient, place your fingers just outside the left ovary and your thumbs on the near side of the right ovary, make deep pressure with the thumbs, pressing the contents of the pelvis to the left side; now press your fingers well down and narrow the distance as much as you can between the fingers and thumbs; carry the pressure as far as possible without inflicting any severe amount of pain until resistance renders further movement impossible; then roll the intervening structures. You have now included within your grasp the uterus and its appendages; repeat this operation some twenty times, and then use pressure with your fingers across the pelvis backwards and forwards from one anterior superior spinous process of the ilium to the other. Of course a great deal will depend upon the amount of fat and the rigidity of the abdominal muscles, but these obstacles can be overcome by care and determination; finally tapote with the ulnar side of the fingers. I must admit that these, like other manipulations, require practice, and the success which attends you in your work will be dependent upon your practical skill, dexterity and insight. We pass on now to consider the ovaries.

The Ovaries.—In the first place I think it is exceedingly important that you should know as far as is practicable the exact position of these organs as they exist in the living body. Upon this patient I have mapped out with pencil the abdominal regions as correctly as it is possible to do. M. Charcot, who has given great attention to this subject, says, "If from a line uniting the anterior superior spines of the ilia you let fall the perpendicular lines which form the lateral limits of the epigastrium, the seats of the ovaries will be exactly at the spots where these lines cross each other." Therefore we are justified in coming to the conclusion that at these points which I now show you the ovaries are to be found in the abdominal cavity; in fact M. Charcot goes so far as to say, that if you pass a needle into the abdomen at these points you transfix the ovaries as he has repeatedly proved. Deep exploration of this region allows us readily to recognize the ovary, especially when enlarged and swollen, which is not unfrequently the case. I shall have to bring before you certain points in my next lecture in connection with the ovaries, when speaking to you of hysteria, but I had better give you a little more information upon this subject at the present time.

I have often drawn your attention in masséeing the abdomen in women to the pain which they frequently experience in the ovarian region, particularly of the *left* side; it is exceedingly common at *the extreme limit of the hypogastric region.* This pain is indicative of the neurosal state of the individual, but it is not of necessity indicative of hysteria as this term is usually and sometimes vaguely employed; it unquestionably denotes exhaustion. A tender, painful, irritable, hyperæsthetic and sometimes swollen state of the left ovary is of itself a sign of nervous weakness, prostration and debility, and oft-times of a purely hysterical state. In women who suffer from hysteria you learn the fact that their attacks commence by peculiar sensations in this region, and that they spread from point to point, that is to the epigastrium (1st node), thence to the throat (2nd node), and finally to the cortex of the brain, leading to unconsciousness and convulsions, therefore the sensation experienced in the ovary and its irradiation is known as the *aura hysterica.* M. Charcot says, "If I am to judge from my own observations, this iliac pain always precedes in point of time, however small the interval may be, the epigastric pain, in the development of the aura, and consequently it constitutes the first link in the chain." I am always inclined to accept everything M. Charcot says as true, without much thought or reflection, but I am not quite in agreement with him on all he says relative to hysteria.

It may interest you to know that methodical compression of the ovary in the hysterical can determine the production of the hysterical aura, and that energetic compression is capable of stopping the development of the attack when beginning, or even of cutting it short when advanced. Although I have rather led you away to the momentary consideration of hysteria, I think you will see that my object has been to show you that the ovary as part of the abdominal viscera is one, and a very important link in the chain associated with emotional neuroses, and a chain, by the way, whose links are so interwoven that the task of picking them asunder and determining their connection and relative value is very far from being accomplished ; but massage, as we saw in our last lecture, is so important in the cure of these conditions that I think you should be acquainted with some of the leading principles and common phases of hysterical conditions. No man can take an interest in his work unless he knows the nature of the soil he is cultivating, the seed which he is planting, and the crop which he may hope to realize.

Hysterical symptoms, and this must not be forgotten, often complicate and cloak those of organic disease. Gowers says, "The effect of disease of one part is often to disturb the functions of other parts, and of this disturbance hysterical symptoms are a frequent result." I have seen serious mistakes made on this account. Weir Mitchell's remark is here most appropriate, "The symptoms of real disease are painted on an hysterical background." Of late years it has become the practice to remove the ovaries in severe cases of hysteria, and in the majority the patients have been relieved. Doubtless the operation exercises a profound moral influence upon the nervous system, yet unquestionably it must be admitted that one source of irritation has been withdrawn. I know a lady well whose ovaries were removed, and her more severe symptoms subsided, but still she cannot be said to be cured. .

We must not forget that functional troubles of a reflex nature may arise from a congestive hyperæsthetic condition of the uterus and the ovaries. Persistent vomiting may have such an origin, therefore I advise you to try abdominal and spinal massage in such cases. I have done so upon several occasions with most excellent results, when other means have failed to do any good whatever.

Sir Spencer Wells writes very graphically of the function of the ovaries in Quain's Dictionary. "We have to remember that at each menstrual period one or other ovary becomes swollen, that one or more of its ovisacs enlarges, opens, and admits of the escape of the ovum it contained; that the fimbrial end of the Fallopian tube grasps the ovary, receives the ovum, and allows of its passage into the uterine cavity; that the uterus itself receives an increased supply of blood, and that its mucous membrane undergoes a series of exfoliative changes. We must consider further how these periodical processes are associated with much that is of supreme importance in the state of the nervous centres, and in the mental condition of women. When we bear in mind their highly complex processes, conditions and relations, the wonder is, not that ovarian diseases should be frequent, but that so many women pass through life without suffering from them."

Visceral Neuralgias are occasioned by some departure from the normal automatic and reflex activity of the sympathetic and cerebro-spinal system of nerves. This want of correlative integrity is manifested by spasm and frequently by retrograde metabolism.

The functions of organic life are, fortunately for us, carried on by a system of reflex acts without our being in any way conscious of their mysterious and wonderful doings. Very few of our movements which are being constantly performed by voluntary muscles are executed by really volitional efforts; but let voluntary muscles become fatigued, as for instance in writers' cramp, then the automatism is destroyed, every act becomes purposively volitional, and co-ordinate automatic acts become inco-ordinate when associated with intensified volition and fatigue; then follow strain, spasm, cramp and pain. Let me reverse this picture and draw your attention to the ceaseless activity of the great sympathetic system of nerves. They are ever recording their existence by impressions upon the spinal cord and brain, in a sphere which is purely their own, disassociated from the conscious ego; but when the integrity of their machinery is interrupted, when, in fact, the human battery becomes short circuited, the ordinary sub-conscious impress becomes intensified and *perceived*, and this conscious perception generates the sense of pain.

It is probable that some cause deranging the functional activity of the spinal cord is frequently the source of visceral neuralgias. It is certain that disease of the spinal cord as we find it in tabes dorsalis may give rise to acute pain in any of the viscera, but of course this is a subject which is quite foreign to my teaching upon this occasion. Neuralgia of the lungs is rare. Neuralgia of the heart is not common. Pain referred to the heart is not uncommon. I have had one case of pure cardiac neuralgia lately under my care in the patient whom you have seen suffering from tic-douloureux. But we must go below the diaphragm for visceral neuralgias. I can do little more than merely refer to them.

Neuralgia of the Stomach must not be included in the pains associated with indigestion, for it may exist when the stomach is empty, and it may be relieved by the introduction of food, and the appetite is not usually lessened; the stomach may be exceedingly irritable, and reject its contents *en masse.* Pressure does not give pain; on the contrary, it often affords a sense of relief. Periodicity of recurrence must also be noted, and if pressure be made upon the mid-dorsal spines they will be found extremely tender. Anodyne medicines frequently fail to give relief; scruple doses of antipyrin or ten grain doses of quinine are sometimes efficacious. I have found blistering the spine useful, but the best remedy is the combined electric current. A large flat electrode (kathode) should be placed over the epigastrium, and the anode should be fixed to the dorsal spines; the current, a weak one, must be kept up for half an hour. I have been disappointed with cocaine as a permanent cure; in grain doses it certainly relieves.

The Liver is at times the seat of neuralgia, but I am inclined to believe that it is often a referred pain from some impediment to the flow of bile in the bile ducts. Massage and galvanism are the remedies in all these cases.

Neuralgia of the lower part of the rectum frequently attended with spasm, and neuralgia of the bladder are best relieved by massage and galvanism. I am very partial to the use of large doses of the mixed bromides in obscure abdominal pains.

The generative organs to which I have just referred are frequently the seats of pain, and here again if you wish to cure you must have recourse to massage and galvanism. In conclusion I should like to say a few words to you about the application of galvanism to the abdomen from a general point of view.

The application of galvanism to the abdominal organs.—You know I have the greatest faith in the value of the combined currents applied to the abdomen in all forms of abdominal disease (malignant disease may be excluded), the result of impaired function, whether they are purely neurosal, neuralgic, dyspeptic, circulatory or catarrhal. I have spoken in this lecture of my electric compress, the use of which I consider to be the best mode of applying galvanism. Faradisation, uncombined with galvanism, may be compared to the stimulant effect of water without spirit, but the two to spirit and water combined; if you wish to influence the deep parts the ordinary faradic current is really of little value. The galvanic current should be reversed every two or three minutes so as to increase its stimulating effect. Do not use the currents too strong. There are some electricians who are known to be good physicists, but who apply currents of great strength. I used to do the same years ago, but I now consider this system not only pernicious, but inefficacious. I have now been applying electricity in every known form and mode for many years, and after daily practice in its application, and noting carefully the effects in all forms of disease, I flatter myself that my opinion is not altogether valueless. I have referred to the strength of electricity before, and in my lectures I never fail to mention it ; if you do not use the *stabile* current, such as we have in the electric compress, you should use it after the *labile* method, by means of a *large* sponge moistened with salt and water (the salt, you know, lessens the resistance), by this means we hope (the theory admits of question) that we increase the catalytic action. The current passing through the sponge must be kathodic, whilst the electrode (anode) may be placed upon any part of the body most convenient; but in galvanizing the abdomen I prefer to place it upon the mid-dorsal spines. This is the sponge electrode which I use. You see the sponge is set upon a zinc plate, which is attached to a long glass handle ; you can move it about the abdomen as you please. If you have a case of dyspepsia to treat you press the sponge firmly upon the tissues in the epigastrium, and keep it there for five or six minutes, alternating the voltaics ten or twelve times ; if you wish to act upon the liver and gall-ducts you apply it to the right hypochondrium ; if to the uterus, ovaries, or bladder, you place it on the tissues in the ilio-hypogastric regions, and so you pass it on to any part of the abdomen. Massage, combined with galvanism, is certainly capable of effecting what either of these agents will not do alone. For instance, in chronic constipation of neuro-paralytic origin, not unfrequently associated with spasm, I apply the current by means of the sponge to the umbilical region for ten minutes, and then I have the abdomen well masséed for another ten minutes, and to make the treatment more effectual I pass this electrode three or four inches up the rectum, still keeping the sponge upon the umbilicus. For the rectum operation it is well to disconnect the voltaic current and use only the faradic; this latter mode of operating has been known to relieve the most obstinate constipation when other means have failed. I feel sure that this procedure would prove highly satisfactory in cases of tympanites and in chronic typhlitis, where there is paresis with distension and dilatation of the muscles and walls of the intestine. In future generations when electrization will.

in all probability, be well known and universally appreciated and adopted, we shall have endless recorded cases of its successful application; at the present time, however, it seems to be looked upon with a great deal of suspicion, distrust and disfavour; and this possibly arises from the fact that it is associated with a set of advertising quacks, although surely this ought not to militate against those who use it in the spirit of scientific truth and inquiry.

Lecture IX.

MASSAGE IN NERVOUS EXHAUSTION AND HYSTERIA.

Diseases of the Nervous System—Difficulty in tracing their origin—The Correctness of the term Neurasthenia—State of the Nervous System in Neurasthenia—Characteristic Features of Nervous Exhaustion—Sir A. Clarke's paper on Neurasthenia—A Typical Case of Neurasthenia—Will the Effect of Psychic Energy—Automatism—Close Alliance between Nervousness and Neurasthenia—Symptoms of Neurasthenia—Cases quoted from Note Book in which Massage and Galvanism were very effective in this disease—Irritable Spine—Treatment—Sea Voyages and Prolonged Travel not always beneficial after Massage Treatment—Case of Hysteria in which the Weir-Mitchell Treatment was eminently successful—Definition of Hysteria and Symptoms most frequently exhibited—Amblyopia—Aphonia—Hysterical Vomiting—Hysteria distinguished from Epilepsy—Charcot on Hysteria in the Male—Shock to the Nervous System experienced in Railway or other Accidents—Railway Brain—Notes of cases of Shock inducing Dementia and Melancholia, also other abnormal Mental conditions—Railway Spine—Charcot on cases of Hysteria and of Hystero-Epilepsy in the Male.

The subject for our consideration to-day is of the greatest possible interest. I shall endeavour to bring into review a class of nervous affections which are allied in their history, heredity, etiology, diagnosis, prognosis and nature. They are essentially diseases of the nervous system.

It is entirely out of the question for me to consider any other than the absolute salient points in reference to the most profound, the deepest, and, I might almost add, the most secret enigmas of the human entity. The greatest learning, sagacity and knowledge up to the present time have been expended to unravel, evolve, interpret, and arrange the connections which link and bind together the physical, physiological, anatomical, and pathological signs and symptoms which are developed, extracted, and produced by some unknown factor directed in the evolution and dissolution of that strange, wonderful, related, but, to us, exceptional region which forms an oasis between the physical, the material, the moral, the intellectual, the mental, the ideational, the metaphysical and the psychical, and which, when viewed from the hopeless belief of the physicist, the materialist, and the scientist, forms a realm entirely subordinate to the great evolutionary doctrine, which at one time was looked upon as the revolutionary, transmitting and metagenetic power which should bring light out of darkness, and convert an unknown problem of infinite omniscience to the level of the sagacity, the intelligence, and the understanding of the mind of man. When we look around and note the feeble, weak, illogical, impotent stuff of which the human mind, even in its most exalted form, is built up, we can well step aside, and allow the express train to pass (as Dr. Wilks so aptly puts it) and smile as it hurls itself and its occupants into an unknown region, traversed, it is true, by lines of demarcation, but leading only to dissolution, irrelative separation, and destructive disintegration.

This may seem a strange introduction to the subject of nervous exhaustion, but the more we study, analyze, investigate, experiment, and reason upon that state which goes by the name of neurasthenia, the more do we feel that we are approaching an unknown goal, a problem of absolutely unknown quantity, whose very existence is lost in illimitable space, but from which agency arises the transformation of other living forces known only to our occult minds as dissolution. You may believe me or not, just as you please, but let me tell you that neurasthenia, as I know it, is inseparably chained to, and indissolubly connected with, every retrograde, deteriorating, and degenerating process which alters the normal constitution of all animate matter, for in those living organisms in whom no nervous system has been detected, there must be its equivalent in an organizing force, which to that living organism is as much a governing and controlling agent as the nervous system is to ourselves. Perhaps I have made clear to you my meaning of the term neurasthenia; it is the catabolesis of our existence.

Just as conscience is to our faculty of knowing ourselves, the moral faculty, the moral sense, pertaining to a cognate integrity of or within us, so is neurasthenia to our organic life. Conscience often creates neurasthenia, and neurasthenia often begets conscience. Chance, I might say good chance, led me a few days ago to look over some old numbers of the "Lancet," and in a copy dated January 2, 1886, I found an article entitled "Neurasthenia," written by the most eminent physician of modern times, a physician whose opinion I greatly respect; and I must admit that after reading it carefully I was compelled to read it again, thinking that I must be mistaken. Sir Andrew Clarke, who was the writer of this article, not only denounced the term neurasthenia, but he also denounced those who ventured to use it. Sir Andrew considered that neurasthenia was a term embodying too much, that it embraced every symptom of every form of disease, that it was, therefore, vicious and misleading, and many other strong adjectives were used to sweep it out of medical literature altogether, and substitute for it the *highly classical* term nervousness.

Nervous exhaustion has a different explanation to nerve exhaustion, and nervousness may or may not be identical with nervous exhaustion. Foolishness may exist in a very wise man, and it does not indicate that he is a fool, but both a wise man and a fool may suffer from nervousness, and yet not necessarily from nervous exhaustion.

Now we are told that to introduce such a term as neurasthenia is to violate a fundamental canon in the framing of a scientific nomenclature, and is in the order of science an unpardonable sin. This is, indeed, matter for reflection, and many a scientist should be humbly though vainly seeking forgiveness at the shrine of science for his errors of commission. Again, we are informed that the term neurasthenia is at once *vicious*, *inaccurate*, and *therapeutically misleading*. I do not admit either the one or the other. I have given considerable attention to conditions which are now generally known as neurasthenic. I see during the year a fair number of patients who are so suffering, and after examining them most carefully, I frankly tell them that I find no organic change in any tissue of the body, that the state is one of functional nerve derangement; and I would much rather do so than tell them that they were on the border land of diabetes, or that in six months they would be suffering from blood-regurgitation through an incompetent valve, or that spasm of their vessels in the brain might ultimately lead to starvation of brain matter, paralysis, melancholia and dementia. These results may, and do, follow the symptoms which we attribute to neurasthenia, but it would be far more vicious to tell the patient what might be, than what really is the truth. The former is the hypothesis and the theory, which might pass away, the latter is the central condition of things as they stand. Well, I now want to be told in what way the term neurasthenia is clinically misleading. If there exists, as the name indicates, an asthenic condition of the nervous system, it indicates that the asthenic state requires something to remedy this defect; it might be very slight, possibly a little oxygen thrown into the blood might suffice, or a well regulated diet, or a course of massage with or without galvanism. There is no drug in the whole Pharmacopœia that can be looked upon as curative; medicines said to be good for nervousness as laid down in Brunton's "Materia Medica" are useless. I was in the habit at one time of recommending neurasthenics to take a voyage, seek change in some genial bracing climate, but they invariably returned not one bit the better. What a tale one could unfold of the impotency of ordinary remedies in curing neurasthenics; therefore we consider that we are more than justified in resorting to those which are extraordinary.

Leaving the malediction of Sir Andrew Clarke against the term neurasthenia, and against myself and others who clearly from his point of view are unpardonable sinners, to whom science can never extend the hand of charity or forgiveness, let us, notwithstanding our burdens, pass on to consider what may be the possible state of the nervous system in neurasthenia or nervous exhaustion. Is it cerebral? Is it spinal? Is it nerve, or is it all the lot combined? Can we find definition from the teachings of Victor Horsley, either directly or indirectly, for he has told us as the result of experiment many things relative to nerve exhaustion which ought to be of incalculable value to the clinical observer? I think it will be admitted by the most carping and captious of critics:

1st.—That in neurasthenia there exists a want of correlative integrity between the cerebro-spinal and sympathetic centres, and in my opinion, this is the fundamental cause, and is often, but not necessarily hereditary.

2nd.—That there is defective antagonism between the centres at the various levels, cerebral and bulbo-spinal, by which a process or processes of inhibition are started and maintained. Governing and controlling centres are subjugated by restraint, so that controlling power is greatly diminished.

3rd.—That the normal activity and interaction which should exist between the nerve centres is inactive and atonic.

4th.—That, without doubt, a state of discord reigns supreme, evidenced by instability, irritability, and mutability, functional depression, dulness and apathy.

5th.—That reflex, automatic, and vaso-motor actions are controlled and inhibited by resistances which they are unable to overcome.

6th.—That the sensory and sensorial side of the nervous system is equally or more involved than the motor.

7th.—That it cannot be conceded that the basal ganglia and the bulb are particularly affected, or that such a condition exists as impoverished nerve force.

8th.—That the tissues and the nerves are incapable of conducting the electric current as in health, their resisting capacity is increased, and the impress is received more slowly by the nerve centres.

The reverse of this occurs frequently when the nerve is weakened from central disease. The nerve centres are so many batteries for engendering nerve force, and it has occurred to me that the human brain may be compared to the galvanic battery. The current strength of electricity is equal to the electro-motive force, divided by the resistance which it encounters in the circuit of the battery; the nervous energy may be said to be equal to the force evolved, divided by the resistance which it experiences in the nerve cell which evolves it, so that the activity of the battery, as well as of the nerve cell, is determined by an increased production of force, on the one hand, or by a diminished resistance on the other. Therefore knowing that the current of a galvanic battery may be modified by changes in the electro-motive force, or in the resistance, or in both, so we may by analogy be fairly and warrantably led to conclude that nervous energy may be similarly modified by changes either in the nervous force, or in the resistance, or in both. If we analyze and compare the electric battery and its excitant fluid with the human battery, the nerve cell and its excitant fluid, the electric current and its electro-motor force with the nerve current and nervous force, the conduction of the electric fluid with the conduction of the nervous fluid, the resistance which they both meet with directly they are generated, and the inter-action which takes place in the battery and in the nerve cell when the circuit is completed, we shall be able to form an adequate idea of the similarity of the capacity of both.

I must now endeavour to portray to you some of the leading and characteristic features of nervous exhaustion. They seem to me to be distinct in most ways from what is called nervousness. Neurasthenics are most careful to make you understand that they are not nervous. The majority of the symptoms are subjective. If there is absolute motor weakness it is generally referred to the left side of the body, weakness of the left arm, dragging of the left leg, and so on. I shall read you from Sir Andrew Clarke's paper the following paragraph, which is the best and the most graphic account which I have ever seen of a compound of *nervousness and neurasthenia.* "But hidden within the signs described as characteristic of neurasthenia, and concealed under such terms as astraphobia, topophobia, agorophobia, claustrophobia, anthropophobia, monophobia, photophobia, mysophobia, pantaphobia, and the like. These are symptoms, various, but related, which anyone with sufficient experience and competent faculties of observation and critical analysis can easily discover, arrange into a well defined group, and present to clinical medicine under the justifiable name of sheer nervousness." (This is, of course, a name or term admitting of scientific definition, which neurasthenia does not! Truly a rose by any other name would smell as sweet.)

"All persons exhibiting this group of symptoms have a tolerably uniform natural history, possess what is understood as the nervous temperament, and are said by members of our profession, as well as by the general public, to be sufferers from 'Nervous debility.' But it is more than doubtful if weakness, used in its ordinary meaning, is the sole or the chief characteristic of sufferers from nervousness.

"For the most part they present the appearance of health.

Always excitable and sometimes depressed, they are often animated and joyous, procrastinating, fragmentary, and inconstant. There are, nevertheless, to be found among them the greatest workers of the times; talking occasionally for hours without fatigue; they are sometimes silent and grave; for the most part, fastidious, refined and cultivated; they fall occasionally under the dominion of sensuousness and the lower emotions; habitually tormented by a physical self-consciousness, they can yet suffer themselves in their devotion to others; despised to the flesh and the world, they often attain to the greatest heights of spiritual life. Always ailing, they are seldom ill. Often condemned to premature death, they live as a rule long beyond the average duration of life, and are regarded by the hard, stolid, and superficial with feelings akin to contempt. It is nevertheless from them, far more than from any other class of persons, healthy or disordered, that we get all that is truest and highest, best and noblest, in science or letters, in art or song."

This description is very excellent and elegant, but we must go a little further and put in a few shades of colour here and there to make it a complete picture of neurasthenia, without however drawing from the signs and symptoms of any allied disorder. In neurasthenia we have, then, in addition to the foregoing defective will power, defective resisting power, defective memory, defective power of application and attention, and not unfrequently the special senses are defective and perverted, *perversion really reigns supreme.*

A strong, athletic, active man, with nerves like iron bands, the head of a large business firm, a man of great capacity and business powers, regular in his habits, temperate, idolized by his family for his social qualities, plays cricket with his boys and beats the lot of them, sleeps well and eats well, can take his twenty mile walk without fatigue, suddenly becomes desirous to increase his income, and expecting to realize a large fortune he launches out into other branches of trade, he fails in his object, and is crushed by opposing forces. It is ascertained that some members of his family are epileptic, asthmatic, diabetic or insane. What is the result? Why the entire being of this strong man is changed. His nights are bad, he turns and tosses in the bed with his head full of cobwebs and confused ideas, a thousand things flash across his mind in as many seconds; still there is a constant reversion to an ever-present something which cannot be well defined, but which he believes to be the cause of his woes. The terrible stillness and dead of night strikes and palls upon his weak, feeble, irritable, active, and acutely conscious being, and banishes sleep, but not dull care and worry; even the beating of his heart, the throbbing of his pulse, or the call of nature is welcome as a slight diversion to the stress, the strain, the tension of an overwhelming, but not overpowering monotony.

The dawn and grey twilight of early morn succeed the fulsome, blank and dreariness of chaotic darkness only to find him wakeful, weary, afflicted, and distressed. The hour for rising has come, and our once strong man, chained and shackled by the demon neurasthenia (it is foolish and puerile to call it nervousness), is found weak, impotent, and powerless; his character, which at one time was distinguished by perspicuity, clearness, fixity of purpose, definition and decision, is now remarkable only for its feebleness, irresolution, indecision, hesitancy, vacillation, doubt, dread, and capriciousness. Just as energy is the capacity for work, as we know it in the physical world, so was this man's nervous *sthenicity*, his capacity for action. But where is it now? Can it be absorbed in that effete, old-womanly, *classical*, *clinical*, canonized, and scientific term *nervousness?* No; nothing of the sort. It is sheer nonsense to admit, or to make bold an attempt to admit, anything so utterly vague, unreasonable, and obscure.

I have only drawn your attention to a part, and a very small part of this man's being. Let us observe him in his social sphere, and we find a dislike, a distaste for, and almost a positive aversion to those very things which at one time gave him the most pleasure. This indifference, unconcern, and insensibility towards his belongings and surroundings are clearly outward and visible signs of an inward and normal volitional effacement. The best, the purest, the noblest and highest instincts of his character have fought the fight for priority and superiority, with the lowest, the basest, and most profane; and the devil for the time holds sway over the spiritual. If we follow this man to his counting house, we there find an utter distrust in those in whom formerly he had the most implicit confidence. He then tries and forces, cultivates and coaxes, his will, to endeavour to bring it into play, but *he fails in will power*, and the more he exercises energy to will, the more does the effort fade away, until finally energy and will seem extinguished.

I hold, and so does everybody else I should think, that defect of will power is one of the most prominent, if not the most characteristic sign of neurasthenia. Volition and function go together hand-in-hand and shoulder to shoulder. The will link is only part of the volitional chain, and if the latter be impaired, will is comparatively influenced. Movement is the special function of muscle, and is associated with the *lowest level* of nerve organization. Combined movements relating to complicated and purposive acts are connected with a *higher* *level*, and if these combined movements are generated, elaborated and co-ordinated by a process of forethought and inductive reasoning, they then belong to the *highest level* of our nervous organization. And this is not an automatic or reflex condition, it is an accomplishment, will being the imaginary force through whose agency energy is subordinated to act in certain lines of discharge and conduction. Will is a function of the moral side just as movement is a function of the physical side of our being. Will, volition, force, energy, power, and result, are co-related, transmutable, and transformable. The power, force, and will may exist in the neurasthenic, but the capacity or energy, as I told you before, is inhibited.

Will, then, must be the effect of psychic energy. We are unquestionably much less volitional than we would have ourselves believe. Automatism is really and truly our normal state. How seldom do we reflect, seriously consider, and use our judgment, in fact our reason, to bring about so-called will effect. The very cause of the neurasthenic state is that the neurasthenic has too much by far of the ideo-volitional, that his normal automatism is subjective to his weak, irritable, and to him, ever present volition. It is only when a muscle is paretic that we recognise its normal automatic function, and we then are made conscious of what volition in respect to that muscle really means; and it is only by an effort of will, and enforced will, that the function of the muscle can be called into action, and not unfrequently the *very effort* of will annihilates its will power. So with the neurasthenic, his consciousness of a desire to will inhibits the power to will, and although the efforts to will are abortive, as long as fixed attention exists, directly this is withdrawn automatism executes what will is unable to perform.

In my opinion, nervousness is a condition distinct from neurasthenia. That the symptoms and signs of the one merge into those of the other, and that they are allied, there can be no doubt; but to my way of thinking, rightly or wrongly, we shall, as science advances, find the term neurasthenia accepted by the profession as indicative of certain phenomena which some would have grouped under the banner of sheer nervousness.

Let us follow up the condition of our neurasthenic patient, for we can now dispose of him in a few words. He is for the most part one of the most unhappy of happy mortals. Oversensitiveness and joyousness alternate with depression and even melancholy. When the latter exists he is called hypochondriacal, and always has a dread or fear of something that may happen; when the former state prevails, he is pronounced excitable and even hysterical; and so the emotional elements of his nature move in cycles, just as the seasons follow each other in rotation.

From the purely physical side we find a general arrest of function and defective metabolism. The action of the heart is variable, easily excited and easily depressed ; the pulse is small, soft, and weak ; the skin is usually dry and harsh, but sudden and profuse sweatings are not uncommon ; dyspepsia, flatulence, and acidity are frequent ; the bowels are irregular, but usually constipated ; the extremities are invariably cold (dead hands and feet) even in the hottest weather ; the extremities are moist and clammy, and tender spots in the spine are easily elicited. These, then, are some of the most common signs and symptoms indicative of neurasthenia.

Pray do not imagine that I have exhausted this subject, for there are many other evidences of the neurasthenic state of a purely clinical nature, associated with respiration, circulation, excretion, and secretion ; but I must pass them by, as they do not come within our present investigations, interesting though they may be. I think it would be as well if I gave you from my note-book a brief sketch of one or two cases which have been treated by massage and galvanism with good results. I will not select them on account of any wonderful effect of treatment, but rather to show some of the various phases which neurasthenia presents.

The first is that of a gentleman, aged fifty, who was brought to me by an exceedingly skilful observer, Dr. Whitehead, of Ventnor. My patient at the age of thirty-five broke down in health from over-anxiety and worry, he then became subject to periodic nervous attacks, accompanied with headaches and utter prostration. During the time from thirty-five to fifty years of age he was, with occasional intermissions, a chronic invalid, with all the symptoms of nervous exhaustion, with the details of which I will not weary you. Sometimes the head was wrong, and he could not collect his thoughts ; sometimes the heart was wrong, and he felt a sense of emptiness over the cardiac region, a sort of vacuum (this feeling of *nothingness*, particularly in the bowels, is very common in neurasthenics) ; sometimes his digestion was wrong ; and sometimes all his functions were wrong together. At times he felt utterly weary upon the slightest exertion, and the least effort would cause his limbs to shake under him. He tried some massage and galvanism upon the continent, but it did not seem to agree with him. He came under my care on the 27th of March in this year, when his chief symptoms were prostration and defective will. Attempts to compel attention in ideation gave rise to intellectual blank and depression. Solace was found only in rest, quietude, and freedom from excitement. The hands and feet were cold, moist, and clammy, the bowels were irregular, and the urine of high gravity (1032), free from sugar. Treatment consisted in massage to the lower limbs, buttocks, and abdomen for one hour in the morning, and to the upper extremities, spine, head and neck, at night; hot water bath with electricity for ten minutes in the afternoon, followed immediately by cold abdominal compress with pack for half an hour. Diet: One pint of hot water sipped down at 7 a.m.; breakfast 8.30 a.m., white boiled fish, cold boiled bacon, dry toast, plenty of fresh butter, equal parts immediate tea and milk; luncheon 1.30 p.m., chop, dry toast, butter, one glass of claret; tea 5 p.m., one pint of hot water sipped down with just a dash of tea to flavour it; dinner 7 p.m., cut from joint, principally mutton, dry toast, and a little green vegetable, one or two glasses of claret.

Note.—On the 12th day the treatment so far has been quite satisfactory, the gravity of urine is 1020; sleep greatly improved; extremities less cold; the masseur says the feet are warmer and much less moist, and normal in their sensibility; before treatment they felt as though they were wrapt in wet chamois leather. His gloom and despondency before treatment gave rise to suicidal intentions, these have quite disappeared; he now takes an interest in his surroundings and cracks jokes; says his bowels are now acting regularly, which quite astonishes him; he had been fighting against constipation for fifteen years.

Note.—On the 30th April is as follows: There is a very decided improvement in every way, mental, moral, and physical. He is never depressed, rarely feels exhausted; joins in conversation, and enjoys an argument (has great brain power, and when well his will is inflexible), bowels acting well, tongue clean; urine clear, gravity ranges from 1016 to 1024, of acid reaction; is not taking medicine, and he has increased two pounds in weight, which was not wanted, his height being five feet nine inches, and his weight a hundred and eighty-six pounds.

I wish now to draw your attention to an irritable condition of the spine, which was discovered in this patient, and which is common in neurasthenia and hysteria. It was not elicited by ordinary pressure, but it became manifest upon the application of the faradic current (and let me tell you this is frequently the case, and in obscure disease of the spine this test should be utilized, for by so doing many errors of diagnosis would be avoided). The masseur found that when using faradic massage it became quite painful as he neared the lower part of the back, and he called my attention to it. I then made careful notes of the reaction of the spine to faradization, and I found an area of hyperæsthesia to the current, extending from the tenth dorsal to the second lumbar vertebra; it extended slightly to the right of the spinous processes. I applied dry cupping to this painful region with decidedly beneficial effect, for after the third daily cupping the pain had quite disappeared. To make a long story short, this patient got quite well. I have seen him since, and he says that the last five months have been the happiest that he has spent for the past fifteen years.

The next case is that of a young gentleman, aged eighteen. He was brought to me on April 30th of this year by his father, for my opinion as to whether massage would or would not do him good. He complained that for the past two years his health had been failing, losing strength and weight, energy and interest. His intellect was dull and inappreciative, and he was listless, apathetic, and indifferent to everything. Very little exertion fatigued him. The appetite was bad, and he complained of a feeling of stuffiness, and a load at the stomach after taking any solid food; therefore as exercise, on the one hand, fatigued him, and eating gave him very great discomfort, he avoided both. He was pale, the muscles were flabby, and the extremities were cold and livid, pulse 60, bowels most obstinate. I might tell you that before he came under my care he had sought the advice of many leading physicians in London without deriving even temporary benefit; in fact, the treatment by massage was the only course left as yet untried. After six weeks of massage, applied night and morning in the usual way, he had acquired strength, lost his indigestion, and gained over a stone in weight. I cannot say that his constipation was cured, but the bowels acted to a slight aperient, whereas before massage the strongest aperients had scarcely any effect upon him. In addition to the massage, the cold abdominal water compress was used for three hours every morning. His diet was highly nutritive and similar to that which we employ in the Weir-Mitchell cure. For the last three weeks general faradization was employed daily. The treatment and the results were highly satisfactory; but I sent him for a long voyage, and I am sorry to say that he returned much in the same state that I first found him.

I have drawn your attention to this case to show you what I have now proved by experience, that sea voyages and travel are not promoted to maintain the good effects which massage and galvanism unquestionably create. If I had kept this gentleman under my care and repeated the treatment at intervals, I believe that I should have permanently cured him. The question here arises relative to the course to be pursued after the massage treatment is concluded; but I have discussed this before in my lecture on the Weir-Mitchell course. I shall say nothing more about it now; but from my experience I cannot recommend sea voyages and prolonged travel, though of the good effects of the treatment there can be no question or doubt; it did for this young gentleman what every other remedy had failed to do.

Upon comparing the two cases you will see that they differ in most respects in their nature. In the first the patient was a man of mature years; he had been an invalid for many years; his condition was allied to the lithæmic and gouty diathesis; his weight was quite equal to the given standard, and his metabolism was fairly active, though imperfect, and the treatment I adopted was such as would have been inapplicable in the last case, which was managed entirely after the Weir-Mitchell method.

The third case which I shall bring before you of the purely neurasthenic type is that of Miss C—, twenty-four years of age. She came to me with a highly neurotic history, pale, emaciated, careworn, fretful, fractious, peevish, complaining of aches and pains in all her joints. Her mother said that for the past four years she had sought the best advice wherever it could be found, but without avail. For the past three years she had been gradually and surely getting worse. Before that time she had been a fine, robust, strong, healthy looking girl, played a good game of tennis, rode to hounds, and enjoyed excellent spirits. The break down of her daughter was to her inexplicable. There was a clear history of consumption on the father's side, and she thought, and in fact she concluded, that her child was fast drifting into consumption. The catamænia had ceased for over twelve months. At times she was so persistently obstinate and self-willed that she could not get her to do anything, threats, kindness, and solicitation were alike unsuccessful, it was just as impossible to drive as it was to lead her. She had abandoned her companions, and thrown aside all her pleasures and enjoyments; she came to the breakfast table looking more weary and tired than when she went to bed. She always sat down to meals, but rarely ate more than a mouthful, complaining that it was absolutely impossible to do more, for she could not swallow. The most she partook of from day to day was a little milk and beef tea, and even this she would often refuse. At times for a day or two she would brighten up and lead her to hope that she was getting better, but she soon relapsed into her terrible state. Her mother said that if she continued in this way much longer it would break her heart; but she had heard of the massage cure, and she had determined that her daughter should try it, although the girl had declared she would not do so. I examined her very thoroughly and could find no organic disease. The circulation was defective; extremities cold and bluish looking; the pulse at the wrist could scarcely be detected, but the heart sounds were clear and well defined; the hair was crisp and the scalp was tender to the touch; the pupils contracted sluggishly when exposed to a strong light; the tongue was furred and the breath was offensive; the bowels were relieved about once a week; she said that she had not slept for months; the spine was not tender to the touch; she had never shown any of the ordinary symptoms of hysteria. Of course she had been surrounded by a host of sympathetic friends and relatives who were constantly recommending her mother to try all sorts of treatment and consult innumerable doctors. She had, in the course of two years, tried homœopathy, hydropathy, galvanic belts, change of air, and baths too numerous to mention, and finally, as I say, it was determined that the *massage cure* should be resorted to, so she came under my care in February of this year. I gave her clearly to understand that she was going to be cured, and that she must submit to any means which I thought proper to adopt. I felt quite sure that in a case of this kind nothing but the Weir-Mitchell treatment, carried out in its entirety, would or could be of any avail, and the mother was quite willing to accept the prescribed rules—seclusion, rest, massage, and galvanism.

The treatment was commenced on the 12th of February, and carried out strictly until the 8th of April, and I can only tell you that this was the most successful case I have ever had. Massage was carried on continuously, night and morning, for one hour during the whole of this time. The diet for the first ten days consisted entirely of milk, of which she took six pints in the twenty-four hours; and upon this diet alone she gained seven and a half pounds in weight, and slept fairly well. At first she was inclined to be rebellious, but this was soon checked by the firm but kindly conduct of the excellent nurse to whose care I entrusted her. The bowels were relieved once in about three days by a morning dose of decoction of aloes. I then ordered her more solid food, which, to my surprise, she took readily, and expressed her delight that she had been relieved of the milk. It was now evident that she was, so to speak, "turning the corner." At 7 a.m. she had the stereotyped cup of black coffee; 8.30 a.m. six ounces of grilled steak, plenty of fresh butter, bread and tea and milk; 10 a.m. beef juice; 11 a.m. massage; 12 a.m. tumbler of milk; 1.30 p.m. cut from joint, fresh vegetables, stewed prunes; 3 p.m. beef juice; 4.30 p.m. tumbler of milk; 6.30 p.m. boiled fish, light pudding, bread and butter; 7 p.m. massage; 9 p.m. beef juice; 10.30 p.m. tumbler of milk. At the end of three weeks she had gained 13 lbs. in weight. Up to this time she had neither seen nor heard of her friends, and she was now anxious to know what the seclusion meant and how long it was going to continue, and when she was going home; but the nurse was equal to the occasion, and managed her most judiciously. At the end of a month she was allowed to feed herself, and after five weeks from the commencement of the treatment she was allowed to get up and sit in an arm-chair for two hours in the afternoon. At the end of six weeks she rose at 12.30 after the morning massage, and did not go to bed until after dinner. She had now gained nineteen pounds in weight; but the transformation in her appearance was simply surprising, she was now a well-developed, handsome, pleasant looking young woman. The formerly careworn, haggard countenance was now radiant with smiles, the pointed features were now replaced with rotundity, and the pale skin was of a good healthy tone.

From first to last no medicine was taken but the aloes, and that was discontinued after the first month, for it was not required. I wish I could tell you that all cases went on continuously well, without interruption, as this one did, but a few such as this are quite sufficient to give you hope and confidence that the result will, in the majority, be the same, and in my experience I am happy to say that it is so. I forgot to tell you that the extremities and trunk of the body were faradized for one hour every afternoon after the first three weeks. I do not find it advisable to commence galvanism until the patient shows definite signs of improvement and begins to take some interest in the curative process; this rarely occurs until the expiration of three weeks.

Hysteria.—I am anxious to say something to you about hysteria, for the reason that it is so difficult sometimes to cure in the ordinary way, and it yields so readily to extraordinary means; of course you know what I imply by extraordinary means, the expression may sound strange to a very orthodox mind, but that does not matter one jot to me. By extraordinary means I wish you to understand modes of treatment such as massage, various forms of galvanism, moral control, and *not* well regulated diet, for in the treatment of hysteria nothing should be *well regulated.* Women not unfrequently drive themselves into hysteria and a host of nervous troubles by trying to regulate their lives by a system of organized machinery. I am perfectly convinced of this myself, if I cannot convince others, that such is the case. I do not believe *existing* in a stereotyped, unvarying, and unswerving groove, it is not compatible with our environment. Change is necessary to functional, intellectual and moral activity. From the earliest ages men have sought diversion because they have found it salubrious. Amusements have been invented, music and song originated, Divine worship has taken different forms, fashions are ever changing, and nature herself assumes different garbs at different seasons, to please, to charm, to change and make glad the heart of man.

Hysteria is a strange morbid perversion of the senses and sensibilities; it is not distinct from nervousness, and it is allied in many ways to neurasthenia. A revulsion will oft-times cure hysteria, but it will not cure neurasthenia. The former is more frequently associated with the emotional part of our nature, the latter rarely, if ever. All neuroses, however, run one into another, but the prime factors are distinct. The term hysteria has unfortunately such a wide and vague significance that its incomprehensiveness, its illusory and delusive phenomena often attach to it an interest and attractiveness which are sometimes unaccountable. Let us take hysteria from its dissimulative point of view; I can only glance at this subject, but it is nevertheless very interesting. These cases not only yield to massage, but they give to the operator an immense amount of credit (to which, by the way, he is not always entitled); and further, I believe a consideration of this subject, however slight, will pave the way to our recognition of a complex state known as "hysteria in the male." Weir Mitchell, in his work on "Diseases of the Nervous System," writes of hysteria as "the fertile parent of evil. However produced, it is a fruitful source of mimicry of disease in its every form, from the mildest of dreamed pains up to the most complete and carefully devised frauds. Its sensitiveness and mobility, its timidity and emotionalness, its greed of attention, of sympathy, and of power in all shapes supply both motive and help, so that while we must be careful not to see mimicry in every hysteric symptom, we must, in people of this temperament, be more than usually watchful for this form of trouble, and at least reasonably suspicious of every peculiar and unusual phenomenon."

This is really true, for it has been my experience to see many cases of organic disease masked by hysteria in its most marked and pronounced forms. But in order to demonstrate this without further comment I will call your attention to the "Lancet" of December 29th, 1888, in which will be found an article by Dr. Smith, medical registrar to the London Hospital, entitled "A case for diagnosis," of which the following are the most important points. A well nourished girl, slightly anæmic, two months before her admission into the London Hospital, was thrown across a bedstead and injured in the back. The injury seems to have been slight and was scarcely referred to. After examination by four physicians of recognised position and ability, it was argued that every organ in the body was sound, and although she complained of severe pain, which appeared to shift from place to place, at one time being in the middle of the back, and again appearing at the sides of the abdomen, the case was considered to be of an hysterical nature. However, the patient lost strength and flesh very rapidly, and died apparently from exhaustion.

At the *post mortem* examination it was found that on the inner side of the lower ribs, one inch to the right of the sternum, was a small mass of a soft melanotic growth; all the lumbar and several of the lower dorsal vertebræ were affected with a similar growth, and very carious. The glands along the bodies of the vertebræ and those of the anterior mediastinum were enlarged, and some of them were blackened, as were also the pelvic and inguinal glands.

I have referred to this case in order to show you how it is possible that pain, the result of obscure cancerous disease, may give rise to hysteria, which, in its turn, may mislead those who are in attendance, however skilful they may be. And again I will call your attention to the fact that the injury to the back would have been, in my judgment, quite sufficient to have given rise to the hysteria, and certainly would have led me to conclude that the case was essentially of an hysterical nature. I have seen several such in my time where moral control had been exercised almost to harshness, thinking that the condition was one of pure hysteria, but after death some obscure cancerous disease was discovered. The wisest and the best of physicians are not infallible, therefore it certainly is necessary, as I have told you, that before commencing operations, and especially for conditions of hysteria, you make perfectly sure, as far as you can do, that you have no organic disease whose existence is veiled by what we know as hysterical symptoms. Hysterical blindness (amblyopia) is not very common. Hysterical loss of voice (aphonia) is very common. The patient can only speak in a whisper. Frequently this is merely one of many hysterical phenomena, but sometimes it exists alone. Gowers speaks of a patient who had been aphonic for two years, with occasional intervals, during which the slightest fright would at once remove her voice. Hysterical amnæsia, ischæmia, chorea, dyspnœa, and so on, are to be met with, in fact there is no form of disease which hysteria cannot simulate. Possibly the most common condition that we meet with is nervous or hysterical vomiting, which is sometimes exceedingly obstinate, lasting for many months, but never giving rise to that emaciation which usually attends vomiting in connection with acute dyspepsia or organic disease.

If we refer to the motor symptoms of hysteria we find general and localized convulsions, spasms, tremors and paralysis. Convulsions are never associated with that profound state of unconsciousness which we find in epilepsy, yet the two diseases run one into the other and give rise to what is known as hystero-epilepsy. The convulsions of hysteria, whether confined to the body generally, or to one side of the body, or to one extremity, are of the tonic kind with intense rigidity, whereas in epilepsy they are both tonic and clonic, and the circulation is markedly influenced by vascular spasm in epilepsy, which is not usually the case in hysteria. The epileptic may be as emotional as the hysteric, but this is the exception rather than the rule. There is a sub-consciousness in hysteria which is lost in epilepsy, that is, during the seizures. The epileptic is constantly exposed to danger from the suddenness of the attack; this is rarely the case in hysteria. The aura of epilepsy is unknown in hysteria, and so are the well known post-epileptic states so well described by Trousseau. The hysterical fit terminates by deep sighs, sobbing and weeping; the epileptic fit is usually followed by sleep. In the latter the tongue may be severely bitten, but never in the former, if so it is exceptional and denotes a mixed condition. Hysterical paralysis of a single muscle, or group of muscles of one extremity or of both, particularly the lower, may simulate organic disease of the brain or spinal cord, and the diagnosis is not at all times easy. In paraplegia of an hysterical nature the reflexes are usually exaggerated, the sphincters are unaffected, and nutrition is unimpaired, and so, as a rule, are the electrical reactions. In both we may have retention of urine which, if not attended to, may lead to rupture of the bladder. I have seen this viscus enormously distended in both conditions without the patient feeling any discomfort or being in any way cognizant of the fact. As I have told you before, it is very important to remember, in hysterical patients never to begin abdominal or other massage without knowing that the bladder is empty. In hysterical hemiplegia (which is not common) the mouth is unaffected, and the arm, if raised, remains in this position and does not fall limp by the side as it does when central disease exists. There are some conditions of simulated disease, the result of the hysterical state, and some points of differential diagnosis which it is well to know. From the little that I have told you,—and time will not permit me to tell you more, although I would like to illustrate each point by cases from my note-book—you will see that hysteria is an unreal or functional disease, it is in fact phenomenal, nevertheless it has a reality and an entity of its own, and its essentially morbid nature indicates defection in the regulating and controlling centres from the highest to the lowest level, to correct which, good moral influence, guided by sound judgment and a comprehensive well balanced mind and will, is absolutely essential. Massage and faradization are unquestionably most important aids in the cure.

Hysteria in the male, railway spine, railway brain.—I am now going to call your attention to what Professor Charcot designates "Hysteria in the Male." Of course everybody knows that men and boys may be hysterical, but M. Charcot has dealt with this subject in a manner which is more or less complete and irrefutable. It is quite true that in the study of phenomenal nerve disease this distinguished observer has better opportunities than possibly fall to the lot of most other observers. The Gallic nature seems to be of less enduring stability than that of the Saxon, and is more liable to exhibit exalted hysterical manifestations.

I am very much interested in this affection, as everybody must be who cares to reflect upon, and if possible to investigate, the more occult phenomena of disease. During the past seven years I have seen a fair average of these cases of unquestionable type resulting from accident, and induced by shock. I shall have occasion to refer to some of these to illustrate my subject. It is quite possible that a large part of the profession is perfectly conversant with what I am going to talk about, and know and appreciate in a thorough and complete manner the points evolved; but there are some members of the profession who have not had the opportunities in their ordinary work of making themselves familiar with these phases and caprices of hysteria. If I may judge from the evidence which I have occasionally heard given in courts of justice, there certainly has been clear want of knowledge concerning these strange and peculiar conditions. I believe Mr. Page refers to it in his work "On injuries of the Spine and Spinal Cord," and in America it has been for years well known, but it was unquestionably M. Charcot who laboured and worked out this subject in a way most complete. His views first appeared in the form of clinical lectures, in "Le Progrès Médical," which were translated and published in the "Medical Press and Circular," 1885, and I have no hesitation in saying that my first interest in the study of this affection arose from my reading those very excellent lectures of the learned professor of the Salpêtrière Hospital in Paris, and although I have myself a good store house of facts to corroborate nearly everything brought forward by M. Charcot, I shall, in what I have to say, take M. Charcot as my guide, my counsellor, and in this matter my friend.

I think everyone will agree with me that it has been noted and observed as long as man has had power of observation that accidents to the body, no matter of what kind, have been followed in some persons by derangement in health, especially of the nervous system. It will be remarked, "So-and-so has never been the same since he met with an accident," either in the hunting field, or in some other way. If this be the case it cannot be doubted that the nervous system receives a shock which may not and frequently is not appreciated at the time, but which produces such a change in the man's nervous system, as to give rise to emotional and psychical disturbances to which the term hysteria as we now understand it may be justifiably applied. These conditions are commonly brought practically before us as the result of railway accidents, and the railway companies not unfrequently have to pay heavy damages, when shortly after the sum has been received the patient may suddenly lose his paralysis and very naturally thinks himself a fortunate man; but the authorities representing the company, I might say naturally from want of knowledge, come to the conclusion that they were swindled and that the recipient of the damages was nothing more nor less than a humbug and an impostor. Now this is not true in a great many, perhaps I may say in the majority of the cases, for it is now well known that very serious and troublesome conditions of the nervous system may arise from railway collisions which render the subjects of them utterly unfit to carry on their occupations for years afterwards. This condition may occur without traumatism, and is simply the result of nervous psychical commotion, therefore we can have this state of "nervous psychical commotion," as M. Charcot calls it, the result of an accident, with or without objective bodily injury: and it is a remarkable fact that the more slight the injury the greater may be the disturbance to the nervous system. The nervous symptoms rarely arise immediately after the receipt of injury, it is commonly the case that the patient recovers from the shock of the accident and is making a start to resume his vocation in life, when, from defective will power, he fails in almost every essential particular to carry out his object.

I mean to conclude my lecture by bringing this subject of railway brain before you in a clear, practical, straightforward manner, which I can do by the able guidance of M. Charcot's lectures.

We must first of all admit that hysteria is induced in men and women by accident, or by anything which produces *conscious* or *unconscious* shock to the nervous system; meeting with some bodily accident being the chief cause, the gravity of the hysterical state not being dependent upon the nature or severity of the accident, wounds, contusions, or fractures, the result of the accident, or the state of the health of the sufferer at the time of the accident. Thus a man who may have received a fracture of the thigh may be incapacitated for work for three or four months, while another who may have sustained *nervous* injury apparently of much less gravity, may be incapacitated for work for six months, a year, or more.

Let me, before proceeding, give you very brief notes of four cases which may the better illustrate my meaning; each differs somewhat in its causation.

A woman about forty years of age was admitted into the Central London Sick Asylum under my care, suffering from ataxy of the lower limbs with hysterical symptoms, marked by periods of vacancy and extreme depression, hesitancy of speech, and general anæsthesia. Remember, if you please, that this woman was noted for strength and courage. She lived upon the coast, and one day during a terrific gale, standing upon the sea shore, she saw her son and his craft submerged and sink in the depths of the ocean. Her friends around were astonished to see the calm indifference with which she viewed the calamitous scene, and beyond the words "My God, my God!" not a word escaped from her lips. For some days she performed her usual work in her usual regular and methodical manner. In a short time, however, she became reticent, gloomy, and dull. She would be seen wandering by the beach alone, frequently at night when she ought to have been in bed, her cries and sobs were sometimes heard above the fury of the tempest or the roaring of the waters. Everyone thought she was going mad. But no; her memory began to fail, and with it the attributes of reason; dementia threatened, and for a while mind and dementia were pretty evenly balance, but she took what I am sure I may be permitted to call an "hysterical turn," and it was in this state that I first saw her, some three months after the shock.

I am not going to enter further into the signs and symptoms of this case, if I remember rightly they are published in some medical periodical, suffice it to say this woman after more than two years recovered, I will not say completely, because I do not believe in the complete recovery of these cases.

Case 2 differs in some respects from that just quoted. A lady about thirty-eight years of age consulted me for a form of melancholia into which she had drifted. Some months previous to my seeing her she had met with an accident and cut the ball of the thumb severely. For a time all went well; the wound healed, and her general health continued unimpaired. But gradually her manner altered, and she conceived the idea that she was going to have "locked jaw," and so strongly did this become impressed upon her mind, that every time she sat down to the table to partake of food her jaw became fixed, so that she lost the voluntary power to open her mouth; yet the jaw was easily depressed, both by her own hands and by the hands of those about her. This continued for some weeks, and then passed away; but the nervous system had received a shock which remained behind; her health suffered, and she became feeble and highly hysterical. At times excitation reigned supreme, at other times she was depressed with evil forebodings of various kinds. Her friends were extremely anxious, and they could not account for her condition, as there was no family history of mental weakness or insanity. She was always complaining of a fixed pain in the thumb. After two years with occasional massage and faradization, her nervous system regained its normal balance, and her general health was restored.

About two years ago, through the kindness of Dr. Gibson, I was consulted concerning the state of a man about thirty years of age, who was travelling on the underground railway at the time of a collision. He was thrown from one side of the carriage to that immediately opposite. He felt dazed for a few minutes, but walked home apparently not much the worse for what he looked upon as a "bit of a shaking." No trace of direct injury could be detected, except some slight bruising over the left shoulder. In a few days he recovered from the effects of the concussion; but, feeling a little out of sorts, went to the seaside, hoping and believing that he would entirely regain his health and strength. He accepted some small sum from the company, not thinking for one moment of any ulterior bad effects. But gradually and surely nervous symptoms supervened, in other words, psychical disturbance and commotion set in. After his return from the seaside he made an attempt to follow his occupation, which was that of a diamond cutter, but although previous to the accident he was a skilled workman, always giving satisfaction to his employers, he now did his work so badly (and for what reason he could not tell) that his master in self-defence was obliged to dismiss him. His health failed, he lost flesh and strength, and became a wreck. In fact, from an even tempered man, an athlete, a good husband, temperate in his habits, and fond of his wife and children, his temperament and his character became completely changed. When I first saw him he was lying in bed, looking the picture of misery, pale, thin, and dejected. On one occasion he made an attempt to put an end to his wife's existence; the society of his children was now utterly distasteful to him; he was taciturn, morose, and distrustful. At times, without cause, he would burst into a furious and uncontrollable fit of rage, and then again he cried and sobbed like a child; he had what he called "horrible dreams," and was fearful of doing anything. He walked with apparent difficulty, the reflexes were exaggerated, but no definite form of paralysis could be elicited.

A man, aged thirty-five, was sent to me by Dr. ——, for my opinion. He had caught his left foot somehow in the tram-car rails, and fell as he said with it twisted and doubled. He was picked up, and walked home a few hundred yards with great difficulty. There was considerable swelling and bruising of the ankle joint, but no bone was broken. Some months after the accident he walked by the aid of crutches into my consulting room. He gave me an account of himself from the time of the accident, which is not important, excepting perhaps that he passed blood with the urine upon one occasion, and his nights were sleepless, and his dreams horrible. He had scarcely got out of bed for three months. When I saw him there was want of voluntary power over the left limb, and he could not move a single toe. He complained of the whole of the left side feeling weak, the left arm felt heavy, and the left half of the body was anæsthetic. When he attempted to think he became confused. He said at times his breathing was difficult; but on examining him carefully I felt convinced that there was no organic disease. Twelve months after this I saw him again, and he was in much the same condition; the left leg was flexed at a right angle with the thigh, and he declared that he had no voluntary power over it, although the muscular reaction to galvanism and faradization was quite normal, and the reflexes were normal also.

I have in the shortest manner possible made an attempt to bring before you the leading points only of four cases similar in their psychical manifestations, which were due to what we call hysteria, the *signs* and *symptoms* differing in *degree* only, and varying with the *inherent capacity* of the individual. In some cases the signs and symptoms are aggravated, accentuated, exaggerated, redundant, obstinate and persistent; in others they are ill defined, feeble, vacillating and unsubstantial; nevertheless, the same centres of the nervous system are alike deranged, the exciting cause being conveyed to, and producing an impress upon these centres, through the special senses, through bodily concussion, or through positive physical injury. Now there are some who seem to hold the opinion that in hysteria the symptoms and signs are *necessarily* fleeting, changeable, explosive, and capricious; but these, as M. Charcot points out, are not unequivocally characteristic of hysteria, even in the female. In woman the phenomena of hysteria may be slight, of low or of high intensity, but they may be durable and permanent, extremely hard to modify, and sometimes resist all remedial interference. It is the permanence and obstinacy of hysterical symptoms in the *male* which render difficult the recognition of their real nature.

"Some," says M. Charcot, "in presence of phenomena which resist all therapeutical agencies, believe that they have to deal with (especially if there exist sensorial troubles with nervous crises) a central organic lesion, an intercranial neoplasm, or if simulating paraplegia, an organic lesion of the spinal cord. Others will voluntarily recognise or even affirm that there can be no doubt in such cases as to an organic alteration, a dynamic lesion simply existing; but in presence of symptoms whose tenacity does not accord with the theory which they entertain of hysteria, they consider that they have here to deal (railway spine) with a special malady not yet described, and which merits treatment apart." It is well, then, that we should make up our minds thoroughly, once and for all, in agreement with M. Charcot and with my own experience. 1st. That in the male in particular the depression and melancholic tendency are observed most frequently in the *cases less accentuated.* 2nd. That the sensorial perversions may, even in the female, present a *remarkable obstinacy,* and that in the male this habitually pertains.

In order to demonstrate those conclusions, I shall offer for your consideration some of M. Charcot's cases, because I find in them a complete and classical study of facts drawn from experience, and conclusions formulated and based upon the practical consideration of the signs and symptoms presented by a large number of patients, tabulated, arranged, and compared with the consummate skill, powers of observation, and judgment, of a master mind. M. Charcot's cases are as follows.

"To illustrate the persistent obstinacy of hysteria in the female, let us consider the patient L——, well known in the records of hystero-epilepsy, and distinguished by the 'demoniac' character of her malady which presents convulsive crises. Her age is 63. She became a patient at the Salpêtrière in 1846, and we have had her under observation since 1871. At that time she was affected, as she is now, with complete *right hemianæsthesia, sensorial* and *sensitive* and *ovarian hyperæsthesia* of the *same* side, which, during the long period of fifteen years, has not been even temporarily modified either by the often tried influence of æsthesiogenic agents, advancing years, or by the menopause. It is now five or six years since our attention has been particularly drawn to the changes which the field of *vision* undergoes in the hysterical, and we have found in this patient a marked diminution of the *visional* field on both sides, but much more pronounced on the *right* side. Repeated examinations, once or twice during each year since that period, have not failed to demonstrate the permanence of this diminution.

"Case I.—The patient R——, a shopman, aged forty-four, became a patient in the Salpêtrière on the 12th of May, 1884, now almost a year ago. He is a stout, muscular, well-developed man. He was formerly a cooper, and bore well the fatigues of his work. The hereditary antecedents of this patient are very striking. His father, aged seventy-six, still lives. During the period from his thirty-eighth to his forty-fourth years, he suffered from '*nervous* attacks,' as to the nature of which the patient is unable to enlighten us. His mother suffered from asthma and died at the age of sixty-five. His grand-uncle on the mother's side was epileptic and died in consequence of injuries received from falling in the fire during an epileptic seizure. R—— has had seven brothers and sisters, none of whom suffered from any nervous affection. Four are dead, and of the three remaining one is asthmatic. He himself is the father of nine children, of whom four died in infancy. Of the five still living, a daughter, aged fifteen, is the subject of nervous crises, another, aged ten, has had attacks of hystero-epilepsy, another daughter is of feeble intelligence, two remaining sons present no physiological or pathological features worthy of note.

"In the personal antecedents the following facts are to be noted. At the age of from nineteen to twenty-two the patient had been the subject of an acute attack of articular rheumatism without any heart complication. As an infant he was timorous; his sleep was troubled by dreams and nightmare, and furthermore he was a somnambulist. He frequently rose during the night and did work which surprised him on finding it accomplished on the following day. This condition lasted from twelve to fifteen years. He married at the age of twenty-eight. There is no proof of any antecedent syphilitic or intemperate history. In 1876 he met with his first accident. He cut himself deeply with a razor, which he was sharpening, and blood flowed copiously. The hæmorrhage and fear combining, he fell to the ground insensible and motionless. He was long in recovering, and for the period of two months he remained markedly anæmic and unable to work.

"In 1882, three years ago, when lowering into a cellar a cask of wine, the rope by which it was suspended suddenly broke; the cask rolled down the stair, and he would certainly have been crushed had he not had time to throw himself on one side; this he was unable to do sufficiently to prevent receiving a slight wound on the left hand. Despite the fear which he suffered he was enabled to assist in remedying matters, but five minutes afterwards he lost all consciousness, and remained in this condition for twenty minutes. On recovering himself he found he was unable to walk, his limbs being so feeble, and he was obliged to be taken home in a conveyance. For two days he was absolutely unable to do anything; during the night his sleep was troubled by terrible visions and interrupted by cries of 'Ah me, I am killed!' He saw in dreams the scene of the accident. On resuming work, *and ten days after the accident*, during the middle of the night, he had his first attack of *hystero-epilepsy*. Since that time the attacks return almost regularly every two months; and often in the interval during the night, or at the time of his first sleep, he is singularly troubled by visions of wild animals.

"Formerly, on recovering from these crises, he could recall what he dreamt during the attack, a circumstance which he is unable to do at the present time. Sometimes he fancies himself in a sombre forest, either pursued by brigands or horrible animals; at other times the scene of his accident opens out before his eyes, and he sees casks which roll upon him and threaten to crush him. Never, he affirms during the lucid interval, has he had dreams or hallucinations of a gay or agreeable nature.

"At this period he went to Sainte-Anne for consultation. He had bromide of potassium prescribed for him, and that medicine, it is noteworthy, had never the slightest effect upon the attacks, notwithstanding that his system had been absolutely saturated with it. It is in consequence of this condition that Rig—— has been admitted into our clinique at the Salpêtrière, and on his entry we marked the following state:—The patient is pale and anæmic; he has little appetite, especially for solid food, of which, however, he prefers acid dishes: altogether, his general health is far from satisfactory. The *hysterical stigmata* are very marked in him. They consist of double *hemianæsthesia in plaques*, over a large extent of surface, to pain (pricking, &c.), and cold. Sensorial anæsthesia does not exist generally, save in a very slight degree. The sense of taste and smelling are normal; hearing is blunted in a marked manner, especially on the left side. The patient does not hear better when a sounding object is applied to the skull. With respect to what concerns vision the symptoms are much less equivocal, and would suffice alone to decide the hysterical nature of the affection. There is *a marked diminution of the field of vision*, more accentuated, however, on the right side. He distinguishes all colours, but the field of vision for blue is narrowed more than that of red, beyond which it passes, a phenomenon when met with which is characteristic, so far as I know, of the field of vision in hysterical subjects—a fact of which I have satisfied you by many examples. Finally, to finish with the permanent hysterical stigmata, there exists in the case of Rig—— two hysterogenetic points, the one cutaneous, and situated below the false ribs of the right side, the other deeper in the popliteal space of the right side, and where an extremely tender cyst exists. There is no hysterical hyperæsthesia of the testicle in the case of Rig——. Pressure, either purposely or accidentally, exercised on the spasmogenistic points in our patient evoke all the phenomena of the hysterical aura, precordial pain, constriction of the neck and hysterical globus, singing noises in the ears and beating of the temples, the two latter phenomena constituting, as you know, the cephalic aura. These points, whose excitation can thus cause, with singular facility, an hysterical attack, are not, on the contrary, following the terminology proposed by M. Pitres, *spasmo-frénateurs*; that is to say, that intense and prolonged excitation of them arrests but imperfectly an attack in process of evolution.

"In the mental condition of Rig——, at present, as in the past, anxiety, fear, and sadness predominate. He cannot sleep in the dark; even in daylight he disinclines to work alone; he is of extreme sensibility, and the sight or remembrance of certain animals, such as rats, mice, and frogs, causes him great terror. These he frequently sees in frightful nightmare or frequent hypnagogic (sleep-inducing) hallucinations. He is always sad. 'I am sick of life,' he exclaims. A certain volatility of spirit is manifested in the fact that he cannot concentrate his mind upon anything, and that he undertakes and abandons with equal inclination five or six enterprises at once. Otherwise he is tolerably intelligent and well-informed, and is of a placable temperament and entirely free from vicious instincts. The attacks are either spontaneous or provoked. However produced, they always arise by a feeling of burning at the spasmogenistic points, after which epigastric pain succeeds, and then a feeling of constriction in the neck and globus, and finally the cephalic aura, consisting of noises in the ears and throbbing of the temples. At this moment the patient loses all conscience, and the attack, properly speaking, commences. It is divided into four periods, well defined. In the first the patient manifests some epileptiform convulsions. Then comes the period of violent spasm, interrupted from time to time by convulsions, at one time of an emprosthotonic nature, at another of an opisthotonic nature, the feet and head alone touching the bed. During that time the patient emits wild cries. Then comes the third period, during which he speaks and emits cries in harmony with his sombre delirium and the terrifying visions which pursue him. Sometimes it is the forest, the wolves, and other wild animals which frighten him; at other times it is the ladder, and the wine-cask. Finally he regains consciousness, knows the persons by whom he is surrounded, and is able to name them; but the delirium and the hallucinations continue still some time; he searches around him and under his bed for black animals which menace him; he examines under his arms for the bites of animals which he believes to feel. Then he comes to himself; the attack is terminated, but to return most frequently a few instants afterwards, when, after three or four successive attacks, the normal condition is attained. During these attacks he never bites his tongue nor passes urine in bed. For one year R—— has been treated by means of static electricity, which, as you know in such cases, has given good results in our hands. At the same time we have prescribed all the tonics and invigorating agents imaginable. Notwithstanding the hysterical stigmata and attack persist without any appreciable change, though they have now existed for a period of three years. We have here to deal with a case of *hystero-epilepsy* with *mixed crises*, as sharply defined as possible. It is clear that the permanence of the hysterical stigmata in this case ought not to cause us hesitation in our diagnosis.

"To conclude with the details of a case so perfectly unique, I shall indicate some particulars brought into prominence by clinical analysis.

"In the first place we have the strong hereditary nervous family history; hysteria apparently in the father; grand-uncle and cousins-Germaine, epileptic; two sons, one hysterical, and the other hystero-epileptic. You will frequently encounter the conditions of heredity in hysterical males more accentuated even than in the female.

"I would recall to you how, in our patient, the hysterical manifestations developed themselves after an accident which threatened his life. The wound of which they were the consequence was of a trifling nature—could it have been sufficient to provoke the development of the nervous disease? That is possible, but I would not confidently affirm it. In all cases of injury it is proper to keep in view a factor, which, in the genesis of nervous complications, operates probably in a stronger manner than the injury itself. In this case we have the terror experienced by the patient at the moment of the accident, and which manifested itself afterwards by a loss of consciousness and a kind of transitory paresis of the inferior extremities. That same psychical element existed in the cases described by MM. Putman, Walton, Page, Oppenheim, and Thomsen, and its influence, often predominant, ought not to be overlooked.

"That same circumstance of the development of hysterical phenomena in consequence of shock, with or without traumatism, but where emotion strongly operates, you will discover in most of the other patients whose cases I am about to bring under your notice.

"Case II.—The man under your observation is named G., æt. twenty-seven, a locksmith by trade. On the 28th February, 1884, he became a patient of my colleague, M. Luys. As to his parents, he knows only that his father died at the age of 48, a confirmed drunkard, and that his mother still lives, and has never suffered from any nervous affection. He has had seven brothers and sisters. But one of his brothers is living, and he is not aware that he has ever suffered from any nervous affection.

"Towards the age of twelve or thirteen he became very timid, and was unable to remain alone in a room without experiencing a feeling of anxiety. Otherwise he was not irritable, nor of a troublesome character. At school he learned easily, and later, towards the age of seventeen or eighteen, he manifested marked proficiency in his trade. He frequently obtained medals of proficiency in competitions in connection with his special calling. Towards this period he unhappily developed an inordinate penchant towards females and drink. He wrought during the day at his trade, but his evenings were passed at taverns or with females. Such excesses were repeated frequently during the week. He was thus deprived of the normal amount of sleep. Meanwhile he did not appear to be unduly fatigued; he wrought as usual, and satisfactorily acquitted himself of his duty.

"At the age of 21, in 1879, during one of his nocturnal expeditions, he received a cut from a knife which penetrated the left eye. He was immediately taken to the Hôtel-Dieu, and placed under the care of M. Panas, who after some time enucleated the injured eye. On leaving the hospital G. was not slow to resume his riotous life.

"Towards the commencement of 1882, at the moment of shutting his eyes in order to sleep, he experienced the vision of a monster in human figure advancing towards him. Frightened, he emitted a cry, and on opening his eyes the vision disappeared, but to return whenever he closed his eyelids. He fell into a state of extremely painful anxiety, and he frequently remained in this condition for a great part of the night, being consequently unable to sleep.

"These hypnagogic hallucinations continued during six months, when in July, 1882, the patient was the subject of a more terrible accident than the first. Occupied in fixing a balcony on the third story of a mansion, when doubtless in a state of intoxication, he fell to the ground, landing, as he alleges, on his feet. During an hour subsequently he was in a state of total unconsciousness. On recovering he was again carried to the Hôtel-Dieu, and placed under the care of M. Panas. It would appear at this time a fracture of the skull was suspected. Meanwhile the progress towards recovery was slow, and it was only after a lapse of two months that the patient was able to return home. Soon after the terrible nocturnal hallucinations reappeared, and for the first time the spasmodic attacks. At first these were not so characteristic as they subsequently became. They consisted especially of vertigoes coming on suddenly, and followed by rigidity, and then by trembling of the members. There was no loss of consciousness. Furthermore, they were not frequent. Matters remained in this state during eighteen months. About this time the treatment of the various physicians was found to have no effect, and G. left, in order to enter the Salpétrière (under M. Luys).

"A short time after his admission G. became subject to frequent abdominal and gastric colic, followed by a feeling of constriction about the pharynx, and vomiting, which supervened, without any effort. These complications, for which medicine was employed in vain, suddenly ceased about six weeks afterwards. Towards this time the existence of a right hemianæsthesia was discovered, and likewise a particular trembling of the hand instantly to be considered.

"In January, 1885, in consequence of changes in the staff, the patients of M. Luys were committed to our charge, and it was then that G. was seen for the first time. He is, as you know, tolerably muscular and vigorous, and his general health appears satisfactory. His mental condition does not present any marked anomaly. The nocturnal (hypnagogic) hallucinations have almost entirely disappeared for a year. G. is not sad, and he willingly converses with the other patients, and renders himself useful in the ward.

"The right hemianæsthesia is absolute; neither contact nor pricking is felt on this side of the body. The organs of sense of the same side are equally affected—hearing, the sense of smell, and taste in particular. With respect to the organ of vision, regular examination discloses characteristic abnormalities. On the right side—you have not forgotten that the left eye is wanting—the field of vision is extremely diminished. Red only is perceived by this eye, and the circle of that colour is reduced almost to a point.

"The trembling of the right hand above referred to is remarkable for the perfect regularity of its rhythm. It consists of oscillations numbering on an average five in a second. In this respect it is intermediate between the slight oscillations of paralysis agitans and the vibratory trembling or rapid oscillations of general paralysis or the malady of Basedow. It is not exaggerated under the influence of voluntary movements. The patient is able to use his hand for the purpose of eating and drinking, and is even able to write tolerably well, providing he balances his right wrist on his left hand, a manœuvre which arrests the trembling for an instant. The muscular sense is entirely preserved in every part of his right arm. The sole hysterogenetic zone found in G. occupies the course of the spermatic cord, almost up to the right loin. The skin of the scrotum of this side is extremely sensitive, and when it is pinched firmly the same effect is produced as by compression of the cord, that is to say, either the development or the arrest of an attack.

"These attacks, either spontaneous or provoked by excitation of the hysterogenetic zone, are always preceded by the sensation of a perfectly characteristic and painful aura, which originates in the right scrotal region, extends to the epigastric and cardiac regions, then to the throat, determining a feeling of constriction, and finally affecting the head, causing singing noises in the ears, especially the right, and throbbing, chiefly of the temple of the same side. The patient then loses complete consciousness; the epileptoid period has commenced; the trembling of the right hand is increased, the eyes are turned upwards, the extremities are extended, and the fists are in a condition of exaggerated pronation. Soon the arms are approximated to one another in front of the abdomen in consequence of a convulsive contraction of the pectoral muscles. After this the period of contortions supervenes, characterized especially by extremely violent movements of salutation, intermingled with mixed gestures. The patient breaks or tears whatever he carries in his hands. He puts himself in the most ridiculous *poses*, so as to justify the term *clownism*, which I have suggested to designate that part of

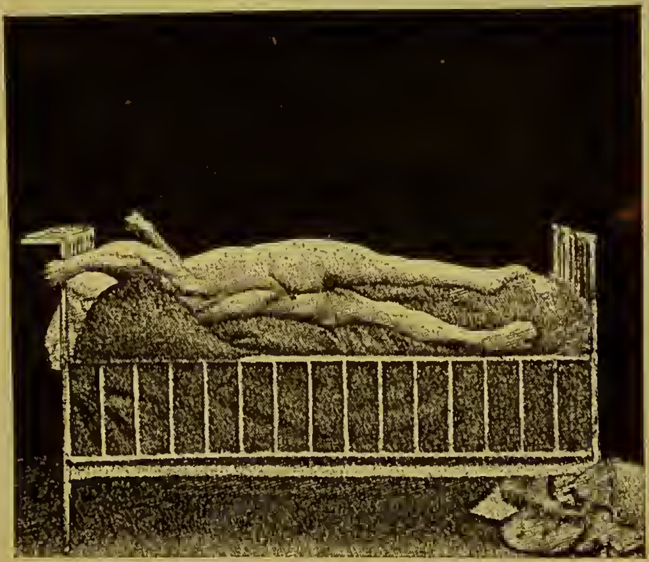

Fig. 28. Arc of a circle backwards.

the second period of the attack. After a time these contortions cease to be followed by a characteristic attitude designated an 'arc of a circle.' Soon there is a veritable opisthotonos, in which the loins are raised above the bed to a distance of fifty centimetres, the body reposing only on the head at the one extremity and the heels at the other. In other instances the circle is forwards, the arms are crossed upon the chest, the thighs are in the air, the trunk and head are raised, and the buttocks and loins alone rest on the bed. At other times, in the attitude of the arc of a circle, the patient reposes either on his right side or on his left. All this part of the attack in G. is exceedingly pretty, if I may thus express myself, and each of the details deserves to be fixed by instantaneous photography. I show you representations thus obtained by M. Londe. You notice that, as a work of art, they leave nothing to be desired. For us they are otherwise most instructive. They show us, indeed, so far as concerns the regularity of the periods and the typical character of the diverse attitudes that the attacks in G. are not wanting in anything which we daily observe in hystero-epilepsy of the most classic type in the female sex, and that perfect correspondence is peculiarly worthy of being pointed out, seeing that G. has never entered the female dormitory so as to see feminine attacks and be thus influenced by contagious imitation.

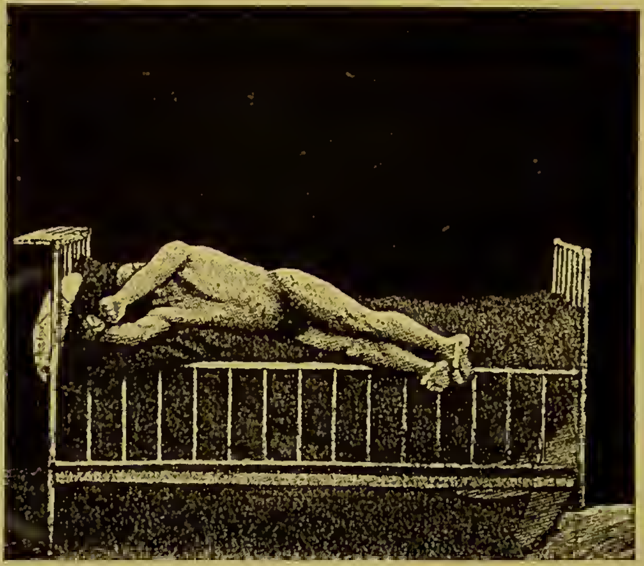

Fig. 29. Arc of a circle forwards.

"The period of hallucinations and passionate attitudes is alone wanting in G. Sometimes we have seen towards the end of a crisis his physiognomy express alternately fear or joy, and his hands extended as in search of an imaginary being.

"The end of an attack is, in our patient, frequently marked by a kind of motor aphasia which does not generally continue more than eight or ten minutes; but on one occasion it persisted for six days. Then when the patient desires to speak, some ropy, inarticulate sounds only escape his mouth. He becomes impatient, but agitates himself so as to make himself sometimes understood by very expressive gestures. In such cases he has been known to take the pen and legibly write some correct phrases.

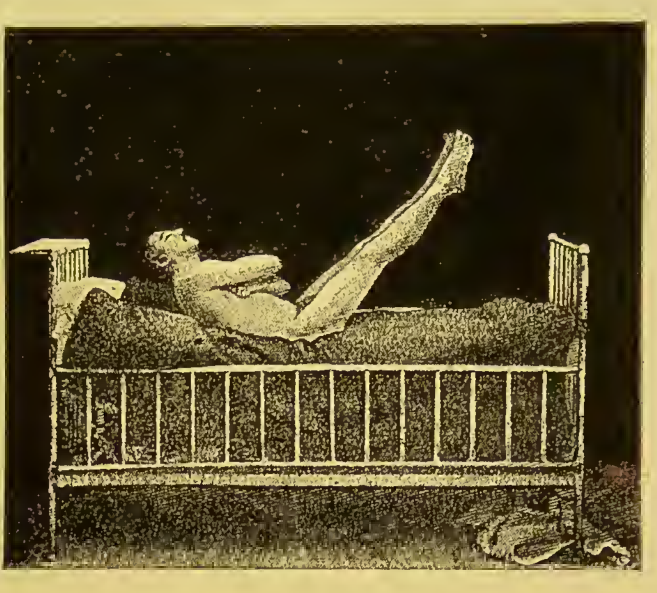

Fig. 30. Attitude illegique.

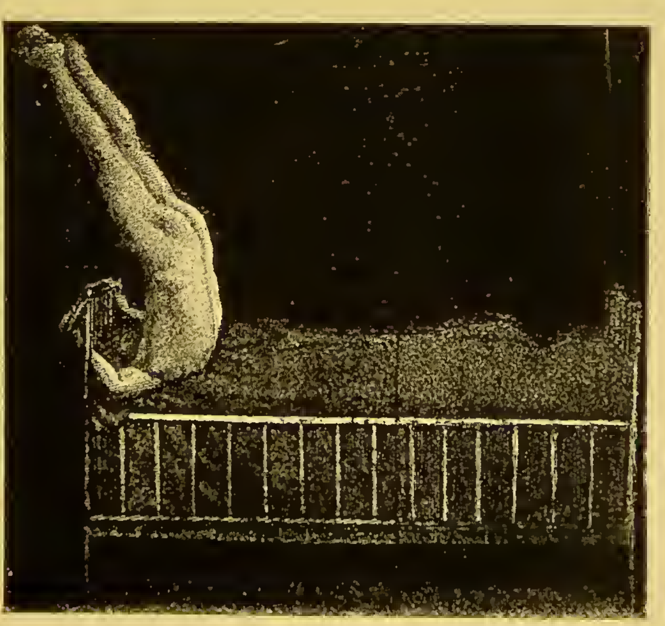

Fig. 31. Forward arc of a circle.

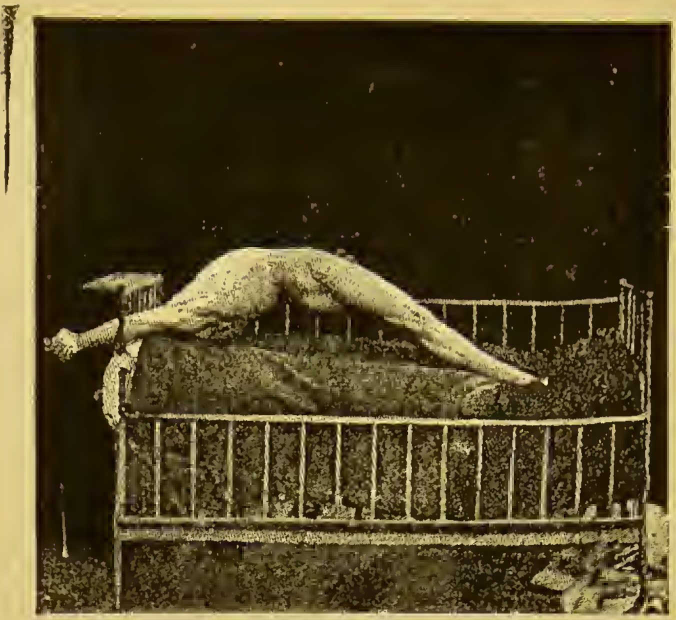

Fig. 32. Backward arc of a circle.

"This is sufficient in regard to this perfectly classical case.

"CASE III.—This case does not quite come under the category of those already referred to, inasmuch as it is that of a growing young man, and not a fully matured individual. But here, also, the disease presents the character of permanence and tenacity which we have already encountered. M——, æt. sixteen, entered our clinique on the 29th of April, 1884, that is to say about a year ago. He was born and lived in the country up to the age of fourteen. In 1872 his mother had some hysterical attacks. His grandfather was a dissipated man, and of a very violent character. This is all that can be determined as to hereditary antecedents; the young man himself is well-developed, though in infancy he suffered from some strumous manifestations, such as discharges from the ears, and glandular swellings in the mastoid region. He is intelligent, of a gay character, and has never exhibited abnormal timidity; but he manifested paroxysms of anger in which he broke everything he could lay his hands upon. Two years ago he was placed as an apprentice with a baker in Paris. A short time afterwards he had an inflammation of the chest, and the consequent enfeeblement of health which ensued was not without its influence in developing the complications which supervened. Some time after this, while yet convalescent, he received a fright, from being attacked in the street by two young men. He fell without consciousness, and was in this state conveyed to the house of his employer. He showed no trace of any wound. From that time he remained during several days in a state of hebetude. He commenced to have painful nightmares which torment him to the present time. He dreamt that he was being beaten, and wakened with cries. Ultimately, in about fifteen days, the hysterical attacks commenced. At first they occurred daily, and presented a series of from eight to ten, sometimes even two series in the same day; then they diminished in number and in intensity.

"At the period of admission into the Salpétrière the following conditions were revealed:—The hysterical stigmata are very marked. They consist of an anæsthesia in *plaques* disseminated irregularly throughout the entire surface of the body, and in which there is complete inability to touch, to cold, or to pain. The sense of hearing, taste, and smell is blunted on the left side, and with regard to vision a *double diminution of its field* exists, being more marked on the right side. On this side the patient is unable to distinguish violet, while on the left he can distinguish all the colours; but on both sides there exists a remarkable phenomenon to which I have frequently called your attention, and which we have already observed in the first of our cases, the field of vision of the red is more extended than that of the blue, a condition as you know at variance with that which exists in the normal condition. There exists but one hysterogenetic point, and that occupies the left iliac region. At the present time, notwithstanding that the disease has existed for two years, the attacks came on spontaneously, at short intervals, about every ten or twelve days. These attacks can be provoked very easily when a moderate pressure is exercised on the hysterogenetic point. A more energetic pressure on this point arrests the attack.

"The attack, whether spontaneous or provoked, is always preceded by an aura; iliac pain at the level of the hysterogenetic point, a sensation of a bolus reaching the throat, buzzing sounds in the ears, and beating of the temples. Then the attack commences, the eyes are turned upwards in their sockets, the arms are extended, and the patient, if standing, falls to the ground with complete loss of consciousness. The epileptoid phase is in general not marked, and is short, but the period of great contortions which follows is excessively violent and of long duration. The patient utters cries, bites everything within his reach, tears curtains, and performs characteristic hysterical movements, the body ultimately taking the form of an arc of a circle. The scene terminates by the phase of passionate attitude, which is very marked in him, and differs somewhat according as the attacks may have been produced. Thus, when the attack has been spontaneous, it happens that the hallucinations are of a gay character, while if the crisis has been produced by excitation of one of the hysterogenetic *plaques* the delirium is always sombre, furious, and accompanied by reproachful speech. In general many attacks succeed one another so as to constitute a series more or less numerous.

"In this subject I must point out the permanence and immobility of the hysterical features, recalling what is often observed in the male. Thus, as you may have remarked in our young patient, notwithstanding that two years have now elapsed, the convulsive crises are as frequent as ever, at the present moment, in spite of all our efforts, and the hysterical stigmata, anæsthetic sensorial, and sensitive are not altered since the day that he came under notice for the first time. There is nothing to hope that they may be soon modified.

"This is not the case usually with young persons, especially if the disease develops before the age of puberty. At that period of life, according to numerous observations which I have collected, the hysterical symptoms are, in general, more transitory, and no matter how pronounced they may be, they are most frequently amenable to appropriate treatment. *

"Here, then, we have an attack of hystero-epilepsy, which in one aspect notably forms an exception to the classic variety.

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* Two days after this lecture was delivered, Professor Charcot admitted under his care a young Belgian of twenty-one years of age, spare, tall, and with fair hair, who, as in the cases referred to, presented the classic characteristics of hystero-epilepsy with mixed crises. In the hereditary history there was nothing noteworthy save a history of alcoholic indulgence in his father. In the personal history figured nocturnal terrors, frequent nightmares, even in full daylight and sometimes visions of animal and horrible figures. In November, 1884, F—— was seriously attacked with cholera. His convalescence was protracted, and for many weeks he remained feeble, subject to cramp in the inferior extremities, and abdominal pains. Three months after his recovery, being still in hospital and convalescing, the sight of a body which was being carried frightened him, and almost immediately his first attack supervened. A subsequent fright decided the situation, for from that period F—— did not cease to be under the domain of terrifying hallucinations, while the convulsions took place regularly every night. From the time of his entry into the Salpêtrière the following condition existed:—Cutaneous anæthesia in disseminated *plaques*; a blunting of the sense of taste and smell on the left side; diminution of the field of vision limited to the right eye: hysterogenetic points, very extended, under the form of hyperæsthesic *plaques* occupying in front, almost all the abdominal surface, and behind, the scapular region, the buttocks, the popliteal space, and the soles of the feet, &c. The attack could easily be produced by moderate friction of the hyperæsthesic plaques. After the usual aura a marked epileptoid state followed. Equally characteristic was the period of the grand movements, and the position of a circle. Finally, succeeded the stage of passionate attitudes, during which the patient seemed to be a prey to a sombre and furious delirium. In this case, as in those we have considered, the hysteria has supervened after an enfeeblement of body caused by a serious malady, or in consequence of a fright, and here likewise was observed all the genuine characteristics of hysteria as frequently observed in the female.

In the first period, indeed, we observe the convulsive complications reproduce themselves almost to the perfect limitation of the symptoms of partial epilepsy, while the contortions, the grand movements, and the arc of the circle are wanting. But in the female this variety is well known, though while rare, I have set before you recently several perfectly authentic examples. This subject, * during the past year, has been attentively studied by M. le Dr. Ballet, one of my former clinical assistants. In considering the cases narrated by Ballet, and that with which we are presently concerned, you will be struck with the resemblance which exists between hystero-epilepsy in the male and that of the female. Another anomaly less rare and less unexpected, in the hysteria of the female, is the absence of convulsive crises. You are aware that, according to the teaching of Briquet, about a fourth of hysterical females have no attacks. The disease in such cases, without losing anything of its autonomy is sympathetically represented only by permanent stigmata, with sometimes several spasmodic or other manifestations, such as nervous cough, permanent contractions, certain arthralgias, forms of paralysis, and hæmorrhage from diverse channels, &c.; but the attacks may be equally absent in male hysteria. The case which I am about to submit to you, as it presents itself to us, offers a good example of this kind. The disease is in a sense complete, for attacks actually do exist; but during a long period of eleven months it was abortive in form, a fact difficult of explanation in certain respects, as you will be able to appreciate. Since the 10th of March last, the young man under observation has been afflicted with left brachial monoplegia, without any trace of rigidity, the limb, in a word, flexible in a high degree, which condition he states extended to ten months previously, and supervened on a wound on the anterior aspect of the left shoulder. There is no trace of paralysis or paresis of the corresponding inferior extremity or of the face. No trace, notwithstanding the remote date of the paralysis of atrophy of the paralysed muscles, a circumstance which, conjoined with the absence of any modification of electric reactions in the muscles, leads at once to exclude the influence—at least the local direct influence of the wound. We were further struck on noticing the carotid regions agitated by violent arterial throbbings. Corrigan's pulse was well marked, and auscultation of the heart revealed the existence of a bruit synchronous with the second sound at the base; and on the other hand we find in the personal antecedents of the patient, a history of

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* Ballet et Crespin, Des attaques d'hystérie à forme d'epilépsie partielle. "Arch. de Neurolgie," 1884.

acute articular rheumatism which confined him to bed during five or six weeks. The idea naturally flashed upon us consequently that this monoplegia depended on a cortical cerebral lesion, limited in the motor zone, in the brachial centre and consecutive to the valvular affection of the heart, but a closer study of the case disabused us of this supposition. Without doubt the monoplegia in question is due to a cortical cerebral lesion principally localised in the motor zone of the arm, but it is not of the nature of a gross material alteration, the lesion is purely "dynamical" "*sine materia*," in short, of that nature which we formulate to explain the development and the persistence of the diverse permanent symptoms of hysteria. That is the conclusion, at least, at which we have arrived from an accurate and detailed examination of our patient.

"Case IV.—The patient P——, æt. eighteen, a mason by trade, entered the Salpêtrière on the 11th March, 1885. His mother died at the age of forty-six in consequence of "rheumatism" (?); his father is an inebriate. One of his sisters, æt. sixteen, is subject to frequent nervous attacks. He is a young man, apparently robust and muscular, but his nervous system functionally leaves much to be desired. From the age of five to seven he was troubled with incontinence of urine. He has always been of mean intelligence, his memory is feeble, and he seems to have made but little progress at school. Further, he is of a timid nature, and is the subject of nocturnal terrors. From the moral point of view he is of unstable equilibrium. From the age of nine he frequently left his father's house and slept under bridges and in railway waiting-rooms. His father having placed him as an apprentice to a fruiterer, then with a pastry-cook and others besides, then commenced his escapades. One night he was arrested in the company of a band of vagabonds, and interned at la Roquette, where his father allowed him to remain for a year.

"Two years ago, at the age of sixteen, he was attacked with general acute articular rheumatism, preceded by erysipelas of the face, and from this time dates the organic affection of the heart, which we recognise at the present moment.

"On the 24th of May, 1884, eighteen months afterwards, P——, then an apprentice mason, fell from a height of about two metres, and remained for some minutes unconscious on the spot on which he fell. He was carried home, and then there were discovered some contusions over the anterior surface of the shoulder, of the knee, and of the left ankle-joint—slight contusions which did not seriously interfere with the use of the affected parts.

"For two days subsequently matters remained in this state, but on the 27th of May, three days after the accident, P——

noticed that his left upper extremity became feeble. He then went to consult a physician who recognised a paresis of all the movements of the left arm, with anæsthesia of that member. On the 8th of June, that is, fifteen days after the fall and eleven days after the commencement of the paresis, he entered the Hôtel Dieu. Here he was examined with care, and the following conditions were demonstrated :—Characteristic indications of aortic insufficiency; the parts which had been contused were not the seat of any pain either spontaneous or provoked by active or passive movements. There was incomplete paralysis of the left superior extremity. The patient was able still, sometimes very incompletely, to flex the hand upon the forearm, and the latter upon the arm ; but all movements of the shoulder were impossible. The paralyzed member was absolutely flexible in all its articulations, and there was no rigidity. The condition of the face, and of the left lower extremity was absolutely normal. So far as concerned the power of motion this was a case of monoplegia in the rigorous acceptation of the word. An examination of the function of sensibility furnished the following results. At this period there existed a general hemianalgesia of the left side ; the anæsthesia was complete only in the upper extremity. From this period there was a double diminution of the field of vision, much more marked on the left side. Finally, on the 25th of June, that is to say, twenty-two days after the commencement of the paralysis, it had become absolutely complete. The diagnosis was undetermined, and the treatment proved inefficacious. Faradization, many times applied, on the left side, resulted only in rendering the sensibility of the trunk less obtuse, and had the same effect on the face and inferior extremity. The anæsthesia and paralysis persisted in the superior extremity. The condition of the field of vision was not modified when P—— left the Hôtel Dieu.

"It was on the 11th of March, 1885, and consequently ten months after the accident, and nine months after the complete establishment of the monoplegia that P—— entered our clinique at the Salpétrière. We verified the conditions already referred to, and a more minute examination furnished the following results. The aortic insufficiency was very characteristic, and there existed a souffle with the second beat at the base, violent arterial beating in the neck, visible to the eye, Corrigan's pulse, and capillary pulse on the forehead.

"The motor paralysis of the left superior extremity is absolutely complete. There are no traces of voluntary movement. The muscular masses have retained their volume, their normal outline and their electric reactions, faradic and galvanic, and are in no sense modified. The tendon-reflex of the elbow and forearm is slightly exaggerated. To cold, pricking and the most intense faradisation throughout the whole extent of the extremity, the hand, the fore-arm, and the shoulder, the cutaneous anæsthesia is complete. In respect of the trunk the anæsthesia is limited by a line passing vertically by the arm-pit and sub-clavicular space in front, and the external third of the scapular region behind. The insensibility extends in an equal degree to the deep-seated parts. The muscles may be strongly faradized, the nervous trunks themselves, the articular ligaments may be drawn, and diverse movements of the joints, torsion, &c., may be performed without the least consciousness on the part of the patient. The ideas attaching to the muscular sense have disappeared. The patient is unable to determine even approximately the attitude in which diverse segments of his body may be placed, the place that they occupy in space, and the direction and nature of the movements to which they have been subjected. Apart from the left superior extremity, there does not exist on this side any modification of motor power, either on the face or the inferior extremity, but on these points, as on the left half of the trunk, analgesia exists as during the patient's stay in the Hôtel Dieu. An examination of the field of vision reveals a normal condition on the right side, while on the left it is enormously diminished, moreover the circle of the red is carried out with that of the blue. Since being in the Hôtel Dieu an interesting change in the field of vision has been produced. Furthermore we discover by the usual methods that the sense of hearing, smelling, and taste is much blunted on the left side. It now devolves upon us to endeavour to determine the nature of that singular monoplegia supervening on the traumatism. The absence of atrophy and of any abnormal electric reactions in the muscles in a case of paralysis extending to ten months antecedently repels, at first sight, the hypothesis of a lesion of the brachial plexus, while the absence of any atrophy alone, and the intensity of the perversion of sensibility permits us to reject the idea that we have here to do with one of those cases of paralysis so well investigated by Professor Lefort and M. Valtat, and which are caused chiefly by violence to an articulation.

"A brachial monoplegia may, it is true, in exceptional cases, supervene on certain lesions of the internal capsule, as has been demonstrated, among others, by Bennett and Campbell in *Brain;* * but in such a case we do not certainly encounter the sensorial and sensory hemi-anæsthesia which is sometimes superadded to total common hemiplegia by lesion of the capsule.

" The occurrence in the right hemisphere of a little hæmorrhagic point, or of ramollissement, determined by embolism in consequence of an organic affection of the heart, a point which one can suppose limited strictly to the motor zone of the arm, one such lesion, I say, may account for the existence of left brachial monoplegia. But on this supposition the paralysis ought to supervene suddenly as on a stroke, however light that might be, and not progressively; it would have been characterised almost certainly, many months after its commencement, by a certain degree of contraction, and by marked exaggeration of the tendon reflexes; it certainly would not be accompanied by perversions of cutaneous and deep sensibility as pronounced as those we have observed in our patient.

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* *Brain*, April, 1885, p. 78.

"We are obliged, then, to exclude in our diagnosis that last hypothesis, and likewise that of a spinal lesion which we do not think even worthy of discussion, as being inadmissible. On the other hand, our attention had been vividly directed towards the significant hereditary antecedents, on the psychical state and habits, on the perversion of sensibility extended—though unequally—on the whole of one side of the body, on the diminution of the field of vision so pronounced on the left side, and marked by the transposition of the red circle, and on other sensorial troubles on the same side. All these constrained us, especially in the absence of any other reasonable hypothesis, to interpret the case as an example of hysteria. Further, the clinical characters of the monoplegia, its traumatic origin—and on that point I refer you to what I have already said—are in no way subversive of this view. Indeed, the limitation to one member of motor paralysis, without involving at any time the corresponding side of the face, the absence of marked exaggeration of the tendon-reflexes, of muscular atrophy, and of the ordinary electric reactions, the absolute stoutness of the member many months after the commencement of the disease, the cutaneous and deep anæsthesia carried to a high degree in that member, the total loss of notions pertaining to the muscular sense, all these phenomena united in one case, as in that of our patient, suffice to reveal the hysterical nature of the paralysis.

"In consequence the diagnosis 'hysteria' was frankly and resolutely adopted. Without doubt, the convulsive attack was an element wanting; but you do not ignore the fact that this is not inseparable from the nature of hysteria; consequently the nature of the prognosis changed. We had not to deal with an affection arising from an organic cause, perhaps incurable. We were able to anticipate, despite the long duration of the disease, either spontaneously or under the influence of treatment, some one of these sudden changes, which are not rare in the history of hysterical paralyses, and of paralysis of flexibility in particular. In any case we were able to prognosticate that sooner or later the patient would recover. The subsequent event soon justified our hopes, and amply confirmed our diagnosis.

"On the 15th of March, four days after becoming our patient, we diligently searched him for what had not been done up to this date, to ascertain if there existed any hysterogenetic zones. We found one situated under the left breast, and another in each of the iliac regions. It was noticed that even a slight excitation of the sub-mammary zone easily determined the diverse phenomena of the aura—a sensation of constriction of the thorax, and then of the neck, beating in the temples, and buzzing sounds, especially in the left ear. But on insisting a little more P—— is suddenly noticed to lose consciousness, to throw himself backwards, to extend his arms, and thus we aided in causing the first attack of *hystero-epilepsy* which the patient ever experienced. This attack was absolutely classic, and to the epileptoid phase immediately succeeded that of the greater movements. These were of an extreme violence; the patient, in the act of salutation, went so far as almost to strike his face against his knees. Shortly afterwards he tears his clothes, the curtains of his bed, and turning his fury against himself, he bites his left arm. The phase of passionate attitudes immediately followed. P—— appeared a prey to a furious delirium: he provokes and excites to the murder of imaginary persons. Ultimately he comes to himself, and he affirms that he retains no knowledge of what occurred. It is remarkable that during the whole of that first attack the *left superior extremity took no part in the convulsions;* it remained flaccid and perfectly inert. From this time the attacks recurred the following days spontaneously, many times presenting also the same features. In one of them which took place during the night of the 17th March the patient passed his urine in bed. Two other attacks followed on the 19th. On the 21st a new crisis supervenes, *during which the left arm is agitated.* On awaking, the patient found to his great astonishment that he was able voluntarily to move the various segments of the limb, *of which he had not the use for a single instant during the long period of almost ten months.* This motor paralysis was not cured, for, without doubt, there remained a certain degree of paresis, but this considerably improved. The perversions of sensibility persisted as formerly.

"This cure—or, to speak more properly, that sketch of a cure—after the diagnosis at which we arrived, ought not to be a matter of surprise to you. But, from our point of view, it occurred prematurely, untimely. Indeed, it was no longer possible to afford to you ocular proof, in their detail, of the characters of that monoplegia so worthy of study. The idea occurred to me that, perhaps in acting on the mind of the individual, by way of suggestion even in the waking state—we learned previously that the subject was not hypnotisable—we might produce it at least for some time. It was thus that the following day, finding P—— coming out of an attack which had not modified the state of matters, I endeavoured to persuade him that he was paralyzed anew. 'You believe yourself cured,' I said to him, with an accent of entire conviction; 'it is an error; you are not able to raise your arm, nor to flex it, nor to move the fingers; see, you are unable to grasp my hand,' &c. The experiment marvellously succeeded, for at the end of a few minutes of discussion the monoplegia returned. I was not anxious on this account, it may be said in passing, for I know from long experience that *what one can do he can undo.* Unfortunately, this did not persist for more than twenty-four hours. The following day a new attack supervened, in consequence of which the voluntary movements became definitely re-established. On this occasion new suggestions which we made were found useless. It remains for me only to-day to apprise you of the modifications which, in that which concerns voluntary movement, are produced in consequence of an attack in a limb formerly completely paralyzed.

"The patient, you will notice, is able voluntarily to move all the parts of that limb. But these movements are not energetic; they do not overcome the least resistance which one opposes to them, and while on the right hand the dynamometric force is equivalent to seventy, the left hand represents only ten. Hence, as I have already stated, if the motor paralysis is not so absolute as formerly, it still persists in a marked degree. Further, the troubles of sensibility were not only in the weakened member, but in all the left side of the body, and embraced the sensorial apparatus. On the other hand, the attacks continue frequently. We have here simply an amendment, and for a complete cure much more has to be undertaken.

"I intend to return, in order to estimate properly, to a consideration of some of the facts of this interesting case, with reference to a study of hysterical paralysis caused by injury, and which I shall lay before you soon. For the present, leaving aside the monoplegia, which constitutes but an episode in the history of our patient, I remark, in terminating, that in the case of this man, as in the preceding cases, hysteria exists in its characteristic phases.

"In considering with you in these two lectures the six significant cases which chance placed under our observation, I have been desirous of convincing you that hysteria, even grave hysteria, is not a rare disease in the male; that it may be found here and there in the ordinary clinique, *where alone the prejudices of another age prevent its being recognised.* I venture to hope that after the accumulation of so many proofs in these times, that notion is destined to hold in your minds the place to which it is entitled."

I have perhaps dwelt too long upon this subject of hysteria, but it is of never failing interest to the physician, and it is one of great importance from its medico-legal aspects. In reference to the latter point I am bound to admit that the predisposition to hysteria and nervous disease should form a basis for the rightful consideration of judge and jurist in awarding damages in all cases where accidents may produce very serious consequences in some, although *without predisposition* they may produce no effect whatever.

Lecture X.

MASSAGE OF THE SPINE AND BACK.

Importance and great value of Spinal Massage—Its effect in raising the Temperature of the Body, the Volume of the Pulse, and the Circulation in the Spinal Cord—Tender points in the Spine—The Hysterical Spine—Cases and Treatment—Illustration of Spinal Massage Manipulations—Faradization through the Body of the Masseur—Illustration—Hammond on Spinal Irritation, caused by Spinal Anæmia — The Application of Galvanism to the Spine—The hot water foot bath as the Negative Electrode—A mild current preferable to a strong one—De Watteville on Ascending and Descending Currents—Static Electricity—Spinal Curvature—Dr. Busch on the Spinal Column—Mobility of the Vertebræ—Mollière on the Etiology and Treatment of Curvature — Barwell on Curvature — Value of Massage Manipulations in Curvature—Dr. Busch on the desirable position for Students in Writing—Muscular Gymnastic Exercises—Dr. Liebreich's Lectures on School Life—Lumbago and Intercostal Neuralgias.

In masséeing the back we have to consider, not so much the parts which come immediately under the influence of our manipulations, as those which are influenced indirectly by them. It is quite true that we have to deal directly with a mass of muscles, whose activity and inactivity deserve consideration. I think it must be obvious that in languid circulations the venous and lymphatic currents in these parts must be subject to considerable retardation, and of necessity metabolic changes must be inactive; both ordinary respiration and more especially extraordinary respiration aid the circulation of the blood through them. I am inclined to believe that nitrogenous products, such as urea and uric acid, accumulate unduly in the juices of their tissues; and although I know that this is hypothetical, still, it is quite possible that they may be the means of imparting to the general circulation an amount of waste material with which the ordinary processes of oxidation are unable to cope, giving rise to gout and rheumatic gout, and probably to disease and functional disturbance in other ways. Let this be as it may, we know that by our massage movements we stimulate the circulation through these muscles to increased activity, and we believe that by so doing we also stimulate the circulation of the spinal cord. The vast importance of masséeing the back can only be underrated by those who are blind to experience and common sense.

I have often drawn your attention to several interesting facts in reference to the effects of massage upon the back. You have frequently seen the capillaries of the skin of this region become intensely active, the whole surface responding by a glow of warmth and increased colour most unmistakable. In other cases, do what you will, the result is negative, or the effect may be to produce a mottled blue appearance. Again, we have frequently observed our patient's surprise at the warmth brought about in the extremities, particularly in the feet, by masséeing the back. Too much consideration cannot be attached to these every day facts; they are of far greater interest and practical value to us than the variations in the elimination of urea, or the increase of temperature taken by the mouth or by the rectum, or by the changes in the pulse at the wrist. Let me tell you that ten minutes' work at the spine will increase the volume of the pulse and the temperature generally more than an hour's work at the body, as a whole, the spine being omitted. You will do well to bear this in mind. I have already spoken to you of the circulation of the spinal cord when dealing with its anatomy and physiology, but I must call your attention again to the fact that the grey matter of the nervous centres is far more vascular than the white substance, and that the grey matter of the spinal cord varies in its area at different levels. You can see this in these diagrams before you, also in any good work on anatomy; it is exceedingly well delineated in Ross's work on the spinal cord. Take, for instance, the cervical and lumbar regions, where it is very extensive compared with the dorsal region. Of course it is evident that this should be the case, seeing that the nerves originate from these parts which go to form the great brachial and lumbar plexuses, and the activity here must be greater than in the dorsal region where the nerves are small and their function limited. Observe that the white substance surrounds the grey matter except at the two points at which the posterior horns come to the surface.

There is no doubt that the functional activity of the spinal cord is frequently impaired owing to some impediment to the normal circulation of the blood through it; in plain words, spinal congestion is more common in so-called functional troubles and nutritional defects than is usually supposed. I have drawn your attention to this because I am a great believer in spinal massage under such conditions; but let me first speak of the diagnosis and therapeutic value of "*tender points*" elicited on pressure with and without galvanism along the course of the spine. This is a subject in which I am much interested, but it has not been thought of so much importance in this country as upon the continent. Braun and Türk have published some excellent monographs on the question, and Trousseau spoke highly of the value of tracing a neuralgia along the course of the nerve to the spine from which it emerged, and then blistering the painful and tender spinal spot. The hysterical spine is different altogether from the congested spine in reference to pain. The pain in congestion may be accentuated at a given spot where it is so acutely tender that the patient cannot bear it touched, but the whole of the vertebræ in hysterical spine is painful and tender, "*it is not, as a rule, a localized tenderness.*"

I have an exceedingly interesting case of hysterical spine under my care at the present time in a lady who is particularly anxious to tell me that she generally has such excellent health that nothing ails her. However, she had been *upset, troubled* and vexed about *something,* her appetite had failed, she could not sleep at night, her memory was bad, and her brain seemed strange and confused. She was suffering agony, as she expressed it, all down the centre of the back. If the back were touched at a certain point in the dorso-lumbar region it made her vibrate all over. The left leg felt numb and heavy, and movement of the legs produced severe backache. I looked upon this case as one of neurasthenia of the spine. The nerve exhaustion being productive of spinal irritability and hysteria, general massage was first applied which produced sleep, it was then applied to the spine with excellent results.

I was consulted a few months ago by a gentleman whose occupation in the city gave him a great deal of brain work. He told me that he found it most difficult to follow his business, capacity for work had failed in the most complete manner. At one time he could go through a mass of figures in a mechanical way without the slightest strain or hitch, but now he became confused, and the more he tried to overcome this the more vacant he grew, until he was compelled to throw his papers aside or he feared he should have a fit, for he felt hot, his sight became dizzy, and his hands clammy, and his forehead covered with sweat. He knew of no cause for this change in his condition; on the contrary, everything was going well with him, but he thought that something ought to be done, for he was getting worried and irritable; his appetite and his sleep also were failing. He had consulted several physicians, and they advised change and rest, and special diet; he had been away and felt better in many respects, but directly he resumed work the same condition persistently returned. As part of my examination I made him lie upon his stomach whilst I carefully pressed every spinous process; no tenderness was elicited, neither did he flinch. I then applied a very weak galvanic current to each spinous process, which gave him no pain whatever until it came in contact with the spine of the eighth dorsal vertebra, when he jumped up and declared that I had been cutting him. At the same time there was violent eructation of wind from the stomach. The galvanism was tried again, of less strength, but with the same result. I told him that however singular it might appear it was my belief that some derangement of his spine was at the bottom of his trouble, and so it proved, for three weeks of spinal massage cured him.

I could give you records of many similar cases, but what the exact condition of the spine may be other than congestion I am unable to say. It is, however, quite possible that in some rare instances there may be periosteal exostosis affecting the lateral masses and transverse processes on one side, and it is quite true, as pointed out by Dr. Meyer and others, that unilateral tenderness may sometimes exist over the transverse process rather than over the spinous process of a vertebra. I must tell you this, that in all obscure conditions known as functional, or what is much more popular, "*liver cases*," where relief has been sought and not found in other quarters, I feel it to be my first duty to examine the spine most carefully, and if I find a tender spot or spots, I also find as the tenderness subsides by galvanism, dry cupping, and massage, my patients improve and in most cases get well. Do not think that I am alone in this experience, for similar observations have been made by a number of other physicians: Anstie, Rockwell, Beard, Onimus, Remak, and Trousseau being amongst them.

We have this morning a new patient for massage treatment in this young woman. She tells me that she is twenty-four years of age; and her mother states that for some time her health has been indifferent. Menstruation is scant and accompanied with great pain. She is listless, apathetic, and sleeps badly, says the least exertion tires her, and everything she takes gives her indigestion. You see she is bloodless, and she is losing flesh. Her employment is to serve behind the counter in a linen draper's establishment. I propose to examine the spine and massage the back, and in order to do so she must be placed thus, in the horizontal position, with the arms over the head, just as you see people when they are about to dive into the water. The first thing I do is to examine the vertebral spines, to ascertain if there be any curvature. I now make pressure upon the spinous processes, one by one, asking her to speak if I give her pain. I begin with the seventh cervical, known as the prominent vertebra. In employing this pressure test, observe that I generally use the knuckle of my first finger, after this manner, so. You see she flinches, I am now pressing the spine of the second dorsal. Well, I go on, there is no pain apparently; again she flinches, I am now pressing the first lumbar spine. Let us try once more. Again you see it hurts her, when I press upon the spines of these two vertebræ, the second dorsal and the first lumbar; but upon no other spine does she feel pain. What does this indicate? I really cannot tell you, for if there was organic disease of the spine the chances are against pain being produced by pressure; all I can say is that spinal tenderness in these regions is often associated with spinal irritability and exhaustion. Spinal tenderness upon pressure is not often elicited in the cervical or mid-dorsal regions. We must, as I have just told you, remember that the second dorsal is in close relation with the expansion of the cord from which the brachial plexus of nerves is given off, and the first lumbar is connected with that portion of the cord from which the lumbar plexus takes its origin. Be this as it may, we will massage the back from the seventh cervical vertebra to the coccyx. I will endeavour to go through every movement slowly and carefully so that you may follow me. First of all, I effleurage quickly and lightly with the flat of my hand the whole surface from the cervico-acromial ridge to the crest of the ilium; I then use my fingers and the thumbs of both hands, planting my thumbs near to the seventh cervical spine and my fingers in the natural way just ahead of my thumbs; my fingers and thumbs now travel downwards and outwards in the direction of the ribs, performing a succession of quick, light, rolling petrissage movements. If you watch you will see that my thumbs are more or less fixed points, upon which my fingers are playing with a layer of skin intervening. I then return, making the same movements upwards and inwards, but my fingers are now fixed points and my thumbs are doing the active work. I repeat these processes until one half of the back is done; I now carry out precisely the same manipulations upon the opposite half. I finish stage number one, now for number two.

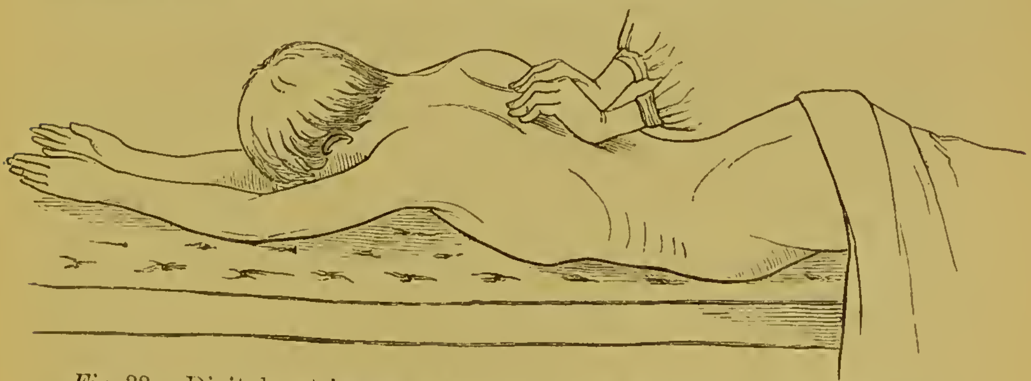


Fig. 33.—Digital petrissage for the back; the fingers are made to travel up the back and drag the wrists after them, without raising the hands from the surface of the flesh.

I place my hands upon the lower and central line of the back (*Fig.* 33), walking up the back, so to speak, with my fingers, and using grip and pressure with them so that they drag the heel of the hand after them. When my hands reach the flesh at the serratal angles of the scapulæ I grasp the tissues firmly and walk my hands backwards in the opposite direction: these movements are repeated some half dozen times. I finish stage number two, now for number three. This is done by working the heels of the hands upwards, with the fingers uplifted; then the return movement is effected with the knuckles.

We have now to consider what I always tell you are essentially back manipulations: *tapotement, vibration, percussion,* and *hacking.* These must be performed quickly, in fact as quickly as possible; they must not be done with undue force. Fix the arms to the sides of the body, and work from the elbows. There are four modes, each of which I will show you. In the first the hand is made into a partially clenched fist, that is to say, the two first fingers press firmly upon the ball of the thumb, so that really the hand forms a cavity, and the ulnar side of the hand and fingers only come into contact with the body of the patient (*Fig.* 34).

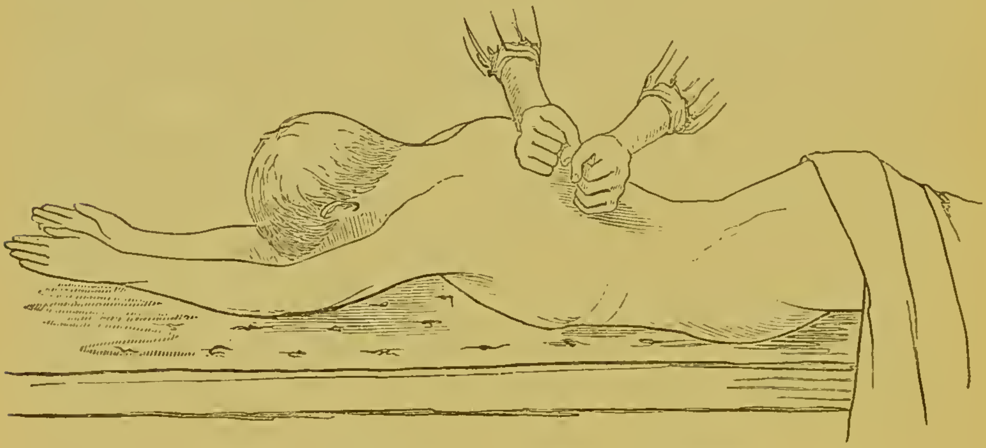


Fig. 34.—Tapotement; vibratory percussion.

The second is not to clench the hand, but to bring the metacarpus and the fingers together in the form of a boat.

The third method is to use the fingers as a flail, working the hand from the wrist; you may use the dorsal surface of the fingers after this manner, or you may use the extreme ends of the fingers in the way I now show you: this is useful to excite the superficial circulation, particularly of the buttocks.

The fourth method, or hacking (*Fig.* 35), is performed by the ulnar side of the hand, or the fingers alone. I do not see any advantage in this over the other methods, still every method has, as we shall see, its special uses in given directions for different parts of the body. I have now finished the back. so far as the massage manipulations are concerned.

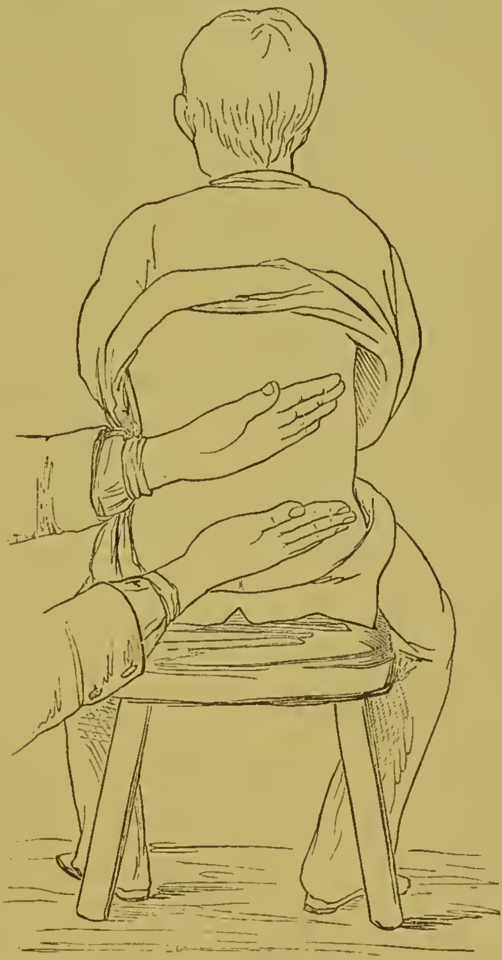


Fig. 35.—Tapotement: position of hands for hacking.

I will take the next patient and show you my method of applying faradization by passing the current first through the body of the masseur. I have referred to this before, but not in the practical manner I should like to do. I take these two flat metal electrodes, well covered with thick chamois leather; they must be made thoroughly damp, *not too wet*. Remember, what we want is induction and resistance; if the electrodes are too wet, or if your hand or the back of the patient is too moist, their conducting power will be too great, and the effect will not be what we desire; therefore we dry the back well by rubbing it with a hot towel, and if need be, cover the surface of the back with a very thin layer of starch powder. Place the larger of the two electrodes underneath the patient's sternum, and the lesser electrode can be fixed upon your arm, or it can be held in your left hand, or placed at the back of your neck. I prefer the last method because it leaves your hands quite free. I have been very careful to see that my electrodes are *just sufficiently moist.* The dorsal surface of the hand always works better than the palmar surface, and frequently you will find that your arm works better than either.

I now make my effleurage movements over the surface of the back generally, and up and down the spine, around the back of the neck and even behind the ears. This form of applying the faradic current is refreshing and gently stimulating; it cannot be strong enough to be painful or to excite muscular contraction if proper precautions are taken. *Neither the patient nor the masseur should be painfully impressed by the current.* This manual form of faradization is exceedingly useful in all functional troubles of the spine, neurasthenia, hysteria, spinal anæmia, spinal irritation, inhibition, exhaustion, and nutritional defects.

Spinal irritation.—Dr. Hammond, of New York (*A Series of American Clinical Lectures*, edited by Dr. Seguin, Vol. ii., p. 277, New York, 1876), has sagaciously endeavoured to prove that the diseases commonly called spinal irritation, hysteria, spinal congestion, exhaustion, neuralgia, etc., should be called posterior spinal anæmia, inasmuch as it consists essentially of an anæmic condition of the posterior columns of the spinal cord. He says, "The symptoms of spinal irritation are both centric and eccentric. Of the former, pain excited by pressure on the spinous processes, or on either side of them, is the most constant, it is sharp, lancinating, and remains for a minute or more after the pressure is removed. Spontaneous pain is not so constant, but may be produced immediately by emotional disturbance. Amongst the eccentric symptoms may be mentioned vertigo, headache, noises in the ears, disturbances of vision, tenderness of the scalp, fulness in the head, loss of power in some of the cerebro-spinal nerves, clonic spasms of the muscles, contractions of the arms, aphonia, and hiccup. The mind may be unhinged, sleep deranged, the dreams unpleasant, and a tendency to somnambulism may be present. Occasionally there is excessive salivation, or the mouth and tongue are parched; nausea and vomiting occur persistently after eating, and there is palpitation of the heart and irregularity of its action. Epileptiform paroxysms, and choreiform movements, beginning in the muscles of the face or arms, and extending to other parts, may also occur.

"Such are the symptoms when the *cervical* portion of the cord is suffering. Where the *dorsal* part of it is affected, there are gastralgia, inframammary pain and intercostal neuralgia, nausea, vomiting, pyrosis, flatulence and acidity, cough, epigastric pulsation, and asthma. The *lumbar* portion, when affected, gives rise to neuralgic pain in the lower extremities, uterus, vagina, ovaries, intestines, or muscles of the back or abdomen, and, in the male, in the testicles. There may be various symptoms on the part of the bladder, and hip and knee-joints."

Dr. Hammond combats in detail the objections which have been, or might be, raised against his theory of posterior spinal anæmia. He ridicules the idea that the spinal cord could not be anæmic unless the whole system were in a like condition ; urges that anæmia may be confined to the posterior columns without involving the other portions of the cord, just as the lesion of locomotor ataxy is confined to a limited sphere in the same organ ; and he then gives his reasons why the symptoms of spinal irritation should be more referable to anæmia than to any other condition. Irritation means weakness, and weakness means defective nutrition or anæmia. An anæmic retina cannot bear the full light of day ; an anæmic heart beats with great rapidity ; an anæmic brain aches ; and in the same manner an irritable spinal cord is the seat of pain ; and organs in anatomical relations, through their nerves, with such a cord, should exhibit indications of morbid sensibility.

The application of galvanism to the spine.—Now that I am speaking to you of the application of massage and faradic massage it seems to me that this is a fitting opportunity to say something of the use or administration of the faradic and galvanic currents to the spine, or of the two currents combined. The first thing which we have to find out is this : Is there any localized organic lesion, or is the condition one of functional derangement? In the former case it is better to apply the stabile galvanic current (bipolar). Place the kathodic electrode over the upper cervical spines, and the anodic electrode over the spines which are adjacent to the seat of lesion. Do not use too strong a current ; five to ten milliampère strength is all that is required. You had much better apply a weak current for twenty minutes than a strong one for ten minutes. The current should be reversed during its transit five or six times. Do this slowly : rapid voltaic alternatives might be highly prejudicial in cases of organic disease. If the spine be irritable and over sensitive the unipolar method is preferable to the bipolar, therefore place the anodic terminal upon the spine (the positive current having a soothing influence) whilst the kathodic terminal is placed upon some distant part of the body. I am very much in favour of the hot water foot bath as the negative electrode ; by this means the density of the more active current is reduced. If there be no organic lesion, and the state of the spine is that of functional derangement only, faradization can be more profitably employed than galvanization, and the labile method is to be preferred to the stabile: sponge electrodes are better than any other: let the sponges be of good size and firm in texture. Hold one of them upon the cervical spines whilst the other is drawn down the entire length of the vertebral column: repeat this process some twenty times; then use the two electrodes conjointly, carrying them from above downwards about two inches apart. It is better to moisten the sponges with strong salt and water, using a weak current; by so doing you are on the safe side, and you avoid any chance of doing harm, you will not be guilty of inflicting unnecessary pain upon your patient, and there will be no fear of aggravating his symptoms. I have often endeavoured to impress upon you the importance of not using too strong currents, though exceptional cases may occasionally require exceptional means. This rule applies equally to galvanization as it does to massage, and my instructions to you in the one case are equally applicable in the other. But I shall again refer to this in my lecture on electrical therapeutics.

As I have been speaking to you of tender spinal spots, I may tell you that these are best influenced by the anodic current. Therefore please to remember, as a general rule in galvanism, that the kathode should be applied to those parts in which there is diminished sensibility, and the anode to those parts in which there is exalted sensibility. Always let your kathodic electrode be much larger than the anodic. When we have localized a neuralgia, and traced the nerve to its origin in the spinal cord, which we probably find gives the reaction of tenderness upon pressure, we can use the combined galvanic and faradic currents with greater chance of success than by using either singly. In using the faradic current alone to over-sensitive and neuralgic parts the object seems to be to over-stimulate and thus benumb them. In recent cases of neuralgia this is all very well, but in cases of some duration, or molecular alteration, where there is a possibility of degeneration, never use a strong faradic current: it checks the onward flow of the blood, depresses the action of the heart, and ends in bringing about dilation of the blood vessels: a weak faradic current, on the other hand, acts reflexly, accelerates the flow of the blood, increases the heart's action, and tones the circulation. Therefore use a weak faradic current in combination with a weak continuous or constant one in all forms of neuralgia, where you want to produce *catalytic* and *cataphoric* effects.

for the reason that we want to diminish the excitability of the nerve, in fact to produce a condition of anelectrotonous. Having graduated the combined current to the required strength (seven milliampère constant) place the anode on the nerve near to or at its centre, and the kathode upon some indifferent part of the body, or upon the periphery of the nerve known to be implicated: a weak descending current applied in this way for some twenty or thirty minutes is not unfrequently followed by the most effective and lasting beneficial results.

There are some observers who conclude that the direction in which a current is applied to a nerve determines an exciting influence, on the one hand, or a depressing influence, on the other. Dr. de Watteville dissents from this view, and in common with other electro-physiologists, gives the following reasons against this doctrine, relative to ascending and descending currents which, however, may or may not be conclusive: (1,) "In physiological experiments on human beings, as well as on frogs' nerves, all the phenomena observed are best explained on the theory of polar influences only; (2,) That it is impossible to send a current of any density in a given direction through a moderately long piece of embedded nerve; (3,) That catalytical effects are independent (so far as can be ascertained) of the direction; (4,) That the theoretical claims set up in favour of specific indications for the use of ascending or descending currents in the treatment of various disorders are not justified by experience. "In fact," says Dr. de Watteville, "among the writers who have based their systems upon the assumed directional differences, a great deal of divergence prevails as to the indications for the current to be used; whilst their practical results agree among themselves, as well as with the results obtained from the application of the '*polar method*' to treatment." These observations and deductions are well worth serious consideration. But, let me tell you, there is much to be learned concerning the application of electricity to the human body, and an ounce of practice is always better than a pound of theory. If points like these are to be settled—and there is no reason why they should not be—it must be accomplished by the most careful and painstaking investigations from the clinical aspect, based upon a sound knowledge of electro-physics. It is often a great mistake, and one which tends to retard the development of sound scientific inquiry, to attempt to reduce the effects of electricity to definite laws before we can formulate with exact certainty the precise existing conditions between cause and effect.

Static electricity.—Let me now call your attention to the value of static electricity to the spine, particularly in cases of hysteria. I have used it in hospital and private practice for many years, and I can speak highly of its worth; and although its therapeutic effects are not generally acknowledged in this country, still upon the continent its application is by no means limited. There are one or two reasons for this. The first is that our usually humida tmosphere, compared to that of Paris and Vienna, is prejudicial to its generation and conduction. The second is that in our published works on electricity nothing whatever is said about it, so that great ignorance prevails regarding its principles. The third is that difficulties are experienced in its production just at the time when it is most wanted, for a dry clear air is essential to its liberation. However, when all things are equal, it possesses one great advantage over faradization, and it is this, that its effect can be produced without the patient undressing, thereby saving considerable inconvenience. I do not think it is wise to compare the advantages or disadvantages of this form of current to that of galvanism or faradization; it appears to me that its effects are, in a way not yet accounted for, dissimilar to either. All those who have noted these, after practice and experience, have come to the conclusion that its influence in spinal irritation and hysteria in all its manifestations, gives to it as a therapeutic agent marked priority over the other forms of electricity.

It is necessary to have a good machine, dry air, and a good insulator upon which the patient can be comfortably seated. A few turns of the handle, as you see, will charge the machine, and I attach the rheophores with the brass poles negative and positive respectively; one is connected with the earth, and the other with the body of my patient. In order to keep up the continuous generation and flow of electricity, the handle should be turned in an active and regular way.

The discharging electrodes vary according to their conducting power; if it is required to withdraw the current in a diffuse and almost insensible manner, this clothes brush answers the purpose perfectly; if, on the other hand, you wish to withdraw the electricity in a concentrated form, you use some pointed metal instrument, such as this which I now show you. Among the many other forms of electrodes, we use a carbon ball, a roller, a rubefacient, an ear and uterine electrode, multiple copper, and steel point electrodes, &c.

I will now discharge my patient through this metal point, by applying it to the muscles of the ball of the thumb. You see with what activity the muscles are stimulated to contract. Let me tell you that this form of electricity is invaluable in protopathic muscular atrophy. My experience is, and I have recorded many cases, that muscles can be made to contract, their nutrition improved, and their substance regained by this means, *when other forms of electricity have been tried for a considerable time and found to be quite useless.* These are incontrovertible facts, and they ought not to be lost sight of.

I have detained you some time with these remarks relative to electricity; they are not only instructive, but of practical value. We will now proceed to the consideration of spinal curvature.

Spinal curves.—I have explained to you the nature of angular and lateral curvature of the spine; and I have told you that massage to the spine *itself* is useless in the former, still I pointed out to you the great value of massage to the extremities in angular curvature, where the patient is unable to take exercise. You know that patients with spinal abscess are necessitated to adopt enforced rest, not only to prevent the spread of the degenerative process in the bodies of the vertebra, but to aid the processes of bone repair; it is apparent that this must be attended by nutritional defects, therefore, massage in these cases is simply invaluable. I am quite sure that before long this will be fully recognised and generally adopted.

In lateral curvature of the spine the case is quite different to that of angular curvature. Here we have no organic disease, and I venture to make the statement (which I know, to say the least of it, will not meet with general acceptation) that nineteen-twentieths of the cases of lateral curvature, where the patients are incarcerated in irons, would get well much more quickly under the influence of massage, galvanism, and suitable gymnastic exercises, than by the use of some of these instrumental appliances, which oft-times increase the condition they are sought to cure, and ruin the health of the wearer. Thanks to Mr. Sayre, of New York, the plaster jacket has in a great measure superseded them, and both Dr. Roth and Mr. Barwell have done a great deal to supplant these cumbrous machines by other more enlightened and satisfactory modes of treatment.

There are other curves distinct from the lateral, and which are not due to organic disease. I will merely mention these as laid down by Dr. Busch, in volume five of Von Ziemssen's Handbook of General Therapeutics.

1st, Rachitic posterior curvature occurring in young children.

2nd, Posterior curvature of youth known as round back.

3rd, The posterior curvature where the back is bent by labour.

4th, The bent back of old age.

I cannot recommend massage as being likely to benefit any of these forms of curvature. Professor Dr. Freidrich Busch refers to the spinal column in the following simple but comprehensive way: "To the vertebral column are attached all other parts of the body; in its cavity is enclosed the central nervous system, the upper part of which in the course of development becomes gradually enlarged and forms the brain, while the bony portions which surround it widen and form the skull. It not only forms the support for the central nervous system, but also for the vitally important thoracic and abdominal organs, and thus Galen not unjustly compared it to the keel of a ship. Corresponding with its great physiological importance, anomalies in position of the vertebral column have a disturbing influence upon a great number of the more important organs of the body, and corresponding to the many structures which are supported by this column, it is peculiarly exposed to various anomalies of position. In this last respect we may also notice the peculiar formation of this bony column, consisting as it does of seven cervical, twelve dorsal, five lumbar vertebræ, and five sacral vertebræ (coalesced into one bone), as well as the four coccygeal vertebræ, the coccyx (an unimportant rudimentary appendix). The erection of these small bones upon a proportionately narrow basis, their connection by the elastic inter-vertebral discs, their limitation by the oblique processes and laterally projecting transverse processes, which in the thoracic vertebræ articulate with the ribs; the ligamentous union of all these parts which cover the bodies consists only of the weak anterior and posterior longitudinal ligaments, but attains the highest degree of firmness at the processes: the attachment of numerous muscles which are amongst the strongest in the whole body; the continued weight sustained by it owing to the erect attitude of man—all these peculiarities produce mechanical conditions of such complexity as to make our comprehension of the normal carriage of the body, and especially of the pathological deviations therefrom, extremely difficult. It is not, therefore, surprising that deformities of the vertebræ have attracted more attention than have deformities of other parts of the body, and that their comprehension is as yet, on many points, imperfect."

Lateral curvature of the vertebral column is more frequent than any other form. It is not unfrequently caused by congenital inequalities of the vertebral column itself, or on unequal operation of weight upon the two halves of the spinal column, or on unequal muscular action, or on cicatricial contraction.

The normal movements of the vertebral column consist in antero-posterior and in lateral flexion, as well as in rotation upon the vertical axis of the body, by which the front of the body may be turned more or less to the right or the left while the pelvis remains stationary.

The cervical vertebræ have the greatest mobility; next to these the three lowest dorsal and two highest lumbar; then the three lowest lumbar vertebræ; the least movable part of the spine consists of the upper nine dorsal vertebræ.

In a clinical lecture by Dr. Mollière, surgeon to the Hotel Dieu in Lyons, upon the etiology and treatment of curvature of the spine, the causes are divided into three main groups: (1,) Affections of the head and neck, including astigmatism, enlarged cervical glands, goitre, contraction of the sterno-mastoid, and hysterical or other paralyses of the muscles of the neck. (2,) Affections of the lower extremities, including congenital dislocation of the hip, coxalgia or "growing pains" in the hip, knock-knee, rickets affecting the tibia, fractures with shortening, a relaxed state of the foot and other ligaments, and juvenile paralysis. (3,) Affections of the vertebræ themselves, or of the thorax, causing true or essential curvature, including pleurisy and excessive exercise of the muscles of one side—such, for example, as existed among the early pressmen, who are represented in old caricatures with a hump near the left shoulder. In addition to these causes, it must be confessed that in a large number of instances there are others which cannot so satisfactorily be made out. Dr. Mollière has given a good deal of attention to this subject, studying the thoracic functions of hunchbacks and examining such muscular theories as appeared to present any hope of a solution of the question. Is, he asks, curvature caused by paralysis of the muscles on the opposite side, as is supposed by some writers? *Post-mortem* examination of hunchbacked women negatived this theory, as no muscular or nervous lesion could be found, and no compression of vessels or nerves in the vertebral foramina. Again, is curvature due to muscular contraction on the affected side? Still less is this the case, for the electrical conditions of the muscles and the want of success in the divisions of muscular tissue proposed by M. Guérin both show the incorrectness of this theory. In order to elucidate the subject, M. Mollière some years ago divided three of the intercostal nerves of one side in a young rabbit close to the foramina, reuniting them immediately. The rabbit became hunchbacked, the curvature being on the side operated upon. The animal was allowed to grow up, and was then killed and examined. No trace of the operation could be discovered, the cicatrisation of the nerves being perfect, and no muscular or nervous lesion being discoverable. This experiment proves, according to M. Mollière, that true curvature of the spine is due to temporary paralyses of the intercostal muscles during youth. These paralyses pass away, but the curvature which is produced on the paralysed side remains.

Mr. Barwell, in a very interesting post-graduate lecture at the Charing Cross Hospital, on lateral curvature of the spine, says: "It is impossible to exaggerate the importance of detecting the malady early, that is, in the first stage if possible, at latest, in the second. I would wish that all parents would subject their children once a year or so to skilled examination. As it is lateral curvatures are very often first discovered by the dress-maker, who finds that she has to make the body of the dress about the shoulders larger on one side, or that the skirt, made equal, hangs lower on the left than on the right. But a curvature discovered by such means is already well advanced, we ought to have it under treatment earlier.

"In order, however, to obtain the earliest possible treatment of a curvature, it is necessary that the initial signs of the approaching deformity be well understood, and let me hope to be pardoned for saying that only a very few people in the profession know what are the early signs of lumbar and dorsal curvature, and therefore it will be doubtless permitted me to go into this subject with some little detail.

"The patient should be placed opposite, and with the back to a window, all cross lights being avoided. The hair is to be gathered up and fastened at the top of the head. The trunk must be bared to the level, at highest, of the great trochanters. All fidgettiness from fear of the garments falling lower must be calmed. A little elastic belt round the pelvis quite secures them. The feet are to be placed together, the hands passed over the lower limbs ascertain that the knees are straight. All this being arranged, the surgeon falls back a step or two and examines the figure as a whole. And now I am going to say something that sounds like, but is not, a paradox. In order to detect a very early spinal curvature, you must not look at the spine. In the first part of this lecture it was said that the vertebræ so rotate that the spinous processes move towards the concavity of the curve; thus it happens, of course, that a certain amount of lateral deviation is compensated by rotation. Thus the tips of the spinous processes may lie in a straight line and yet the spine be crooked. Moreover, the skin of the back has a central mark, the hair bulbs even run from it outward as well as downward, it is always perceptible, though more so in some persons than in others, and is very apt to deceive any one inexperienced enough to look at the spine or what he takes to be the spine, for the first sign of curvature. No, the form and the outline of parts on each side of the column must almost exclusively engage your attention. Let me show the conditions in this patient who has a left lumbar curvature not in the very earliest stage which I could hardly demonstrate in this light to hearers scattered all over the room, but still in a quite early phase and before any consecutive dorsal curve has begun. Fix your attention on the side outline of the figure and note that on the right (concave) side this line traced from the axilla down to the waist (I will call it thoracic portion) is unusually convex or round, bring your eye to the waist and here commences the pelvic portion of the figure with a strong projection, the two portions meet at a pretty sharp angle, or I might express the condition by saying that the incavation of the waist is greatly deepened, and this not merely at the side outline, for running inward from that angle towards the spine is a pretty considerable depression which lies in well marked shadow. Now trace the other, the left (convex), side of the outline from the axilla downward, and note that it is much less curved, the incavation at the waist is much less marked, often nearly absent, while the projection of the hip is slight or almost effaced, there being at junction of thoracic and pelvic portions of the figure no angle as there is on the right side. If the girl has worn stays tightened at the waist, there will be, it is true, at that point a certain narrowing, but the *angular incavation* is never present on the left side as it is on the right. You can, if you like, follow the advice of Lorenz, of Vienna, and letting the arms hang equally by the sides, consider the gap between them and the side outlines as triangles of which the thoracic and pelvic parts of the figure are the subtending sides, the arms the bases. I do not advise this method, as it is easy to be deceived by uneven hanging of the arms. Nevertheless, placing this patient's arms as evenly as I can, you perceive that on the left side the angle in question is very obtuse, and a line let fall from that angle to the base (the arm) is very much shorter than on the right, where the angle is much more acute.

"Having noted these points, the surgeon should approach his patient, and, giving such notice as will prevent a start, should place his forefingers on the crest of each ilium, taking care to have them on the same spot, and should note if the one be higher than the other. In my consulting-room I always place my patient so that in front of the patient a dado or footboard may serve as a horizontal line to assure the eye against being misled.

"If now we turn our attention to the spine and the parts immediately next it, you see on the left (convex) side a slight fulness running along by the side of the central spinal mark upward to the tenth dorsal vertebra, on the other side this is absent. And those of you who will after the lecture examine the patient, will feel that this elevated part is rather hard, while on the right it is soft and yielding, this hardness is perceptible to touch some considerable time before any fulness can be seen. It is not the hardness of muscular contraction, excess of contraction, if any, must be on the other side, it is solely due to the rotation of vertebræ, which is in such direction as to bring the transverse processes nearer to the surface on the convex side, where they form a hard bed for the erector to lie on; while on the right (concave) side those processes have sunk deeper from the surface, and the muscles having in great measure lost their support are softer and more yielding to the finger.

"These changes, subtle as they are in the beginning, can always be detected by an eye gifted with the power of appreciating form; practice, of course, renders that power greater, and let me strongly impress upon you the necessity of making such arrangements as I have described. An imperfect lighting, with reflections and cross shadows, or permitting the patient to hold up her remaining garments with the hands, and so be rendered fidgetty by the fear of their falling may easily baffle attempts at diagnosis.

"It need only be added to this part of my subject, that left curve is the more usual in the lumbar region, but that the bend sometimes occurs in the other direction: the above description, only putting the word left for right, and *vice versa*, will apply to this form. A long simple curve, extending through both dorsal and lumbar regions, is far less usual."

Thus far I have given you the views of three of the most experienced surgeons, relative to some points connected with lateral curvature of the spine, namely, the pathology and diagnosis. There are three grades of this curvature, and it is only the first grade, to which from the massage point of view *I wish particularly to call your attention*, and which in my opinion is due to nerve and muscular defects. It is attended with slight deformity, no special disturbances, and the outer form of the clothed body gives very little indication of its existence. It is different from the second grade, where there is marked defect in the symmetry of the external appearance which at once strikes the practised eye on account of the shortening of the upper part of the body, the projection of the back, and the large circumference of the waist; and although in the second grade of curvature we cannot hope to obtain such good results by properly applied massage as in the first, still I look upon it as an essential and important aid to treatment. Therefore please let it be understood that I particularly recommend massage for lateral curvature of the spine *in the first grade*. I have tried it in many cases with the best results. It is far from my object to tell you of the recognised methods for the treatment of this form of curvature, but from the writings of others, with which I have made myself familiar, I fail to see that systematic massage has been adopted. It is quite possible that after a time we shall find its application becoming more general than it now appears to be. Even Dr. Busch, whose experience in the direction of massage manipulations appears to be greater than that of most surgeons, writes with some hesitancy and doubt concerning this treatment. He says, "Systematic massage of the muscles of the back may *possibly have* some good effect, but must be limited to slight rubbings and kneadings, applied equally to the two sides, as there is too little support for unsymmetrical massage, and therefore the latter would be rather detrimental than otherwise." These observations, coming from a man of large experience, are certainly rather negative than positive, and I should be sorry to recommend the use of massage alone, but as an auxiliary of the *highest possible value, its adoption cannot be ignored.* If it be done at all it must be done thoroughly and completely for an hour every night, when in bed. Of course the general strength should be maintained in every way. The clothing should be warm, light and loose; the diet plain, good, and easy of digestion; cold river and salt water baths are strengthening and stimulating, but never should it be carried so far as to induce fatigue. *The question of fatigue is important, and should be carefully studied in every occupation of daily life, such as exercise, writing, sewing, pianoforte playing, and the like.* Not only should the erect posture of the trunk of the body be maintained in every possible way, but the inclination should be promoted in the direction opposite to the curvature.

Dr. Busch gives some good advice in reference to the position to be adopted in writing; for instance, he says, "In writing it is necessary that the child should sit at a large table with straight (not rounded) edges, the chair so placed that the edge of the table is exactly above the front edge of the seat, the height of the seat such that the elbow can rest on the table in a natural position, the copy-book must lie straight upon the table and the head must not be inclined to one side. The seat should have a tolerably high back, slightly inclined backwards, so that the child when fatigued can rest his back against it. The two ischial tuberosities should rest firmly upon the middle of the seat, and not upon a corner or edge." Muscular gymnastic exercises so excellently portrayed by Schreiber in his work on mechano-therapy should be carefully and systematically carried out, but supervision by a skilled hand is absolutely necessary, or more harm than good may result. If you wish to become acquainted with these exercises let me advise you to consult Dr. Schreiber's book, it is excellently written, and well worthy of study, but to instruct you fully in these and other modes of treatment for lateral curvature is beyond the range of my teaching; nevertheless, as opportunities offer, I shall endeavour to demonstrate them to you to the best of my ability, and although they may be considered too mechanical for the scientific mind of the physician, they are yet full of interest, and it is refreshing at times to be able to lay aside the stethoscope and forget arterial tension, and devote one's self to the consideration of other more objective phenomena, which are so intimately associated with the well-being of man.

My experience has led me to the conclusion that any form of curvature, *no matter how slight*, gives rise to some spinal and brain irritability, and variability of function of the spinal cord.

Dr. Liebreich, the consulting ophthalmic surgeon to St. Thomas' Hospital, gave two interesting lectures, (1,) On school-life in its Influence on Sight; (2,) School-life in its Influence on Figure, and especially on the Spine. He maintained that many of the defects of vision in childhood were mainly due to some slight curvature in the vertebral column, and immediately developed under the influence of school-life. These defects of sight are three in number.

(1,) Decrease of the range of vision, short-sightedness (myopia).

(2,) Decrease of the acuteness of vision (amblyopia).

(3,) Decrease of the endurance of vision (asthenopia).

I am not going to consider the fundamental principles of these valuable lectures, but I merely bring the fact before you. Prof. Liebreich, when consulted by an anxious mother regarding her daughter's eyes, would say, "It is not the eyes, my dear madam, it is the spine which is wrong." My own experience quite leads me to this conclusion.

Lumbago and intercostal neuralgias are best treated by massage, and so is the terribly agonizing pain following shingles; lumbago, which you know is a common painful affection of the muscles of the loins, is frequently conquered by a single masseeing. Pinching, kneading, and hacking are required. The manipulations must be continued until all pain has subsided, and should it not yield to massage alone, the application of the kathode large sponge electrode of a continuous current (15 milliampère) will, in nineteen cases out of twenty, complete the cure.

LECTURE XI.

MASSAGE IN JOINT AND BURSAL AFFECTIONS.

The anatomy of joints—Health of joints necessary to health of muscles—Dislocations—Massage treatment for joints—Inflammation in joints—Point when to begin Massage manipulations—Method of application—Sprains—Mansell Moullin on sprains—Massage applied to sprains—Prolonged rest inductive of anchylosis—Charcot's joint disease—Opinions of Drs. Baker, Barwell, and Sir J. Paget—Rheumatoid arthritis—Drs. Garrod, Ord and Bruce on rheumatoid arthritis—Preference for Massage over other forms of treatment in this disease—Bath as a resort for invalids—The Thermal Baths of Bath—The medicinal properties and great value of the waters—The Massage and Electric Treatment at Bath—Dr. Macpherson's opinion—The Spa at Contrexèville—Bursal swellings—Mucosal and Synovial—Dropsy of the bursa—Stiff joints—Rheumatic and gouty—Treatment.

THE ANATOMY OF JOINTS.—In previous lectures I have dwelt upon the anatomy and pathology of joints. To-day I have to speak to you of those which have undergone no serious alteration of structure, no change, in fact, which cannot be remedied by manipulations and exercises. Please remember that we have to deal with the movable ones, and I may say with them alone. The function of these is to limit and to facilitate movement, so that a joint is essentially concerned in movement. Every organ and every part of the body is best supported and maintained by the due and regular performance of its own function, no matter what that function may be. If its function fail, its special attributes fail in like manner, its nutrition becomes impaired, and it must and does undergo a retrograde metamorphosis of some sort or degree. Remember, if you please, that muscles and joints are functionally and intimately associated; the muscle is the master of the joint. The function of a muscle is movement, the joints respond to a limited degree, and they therefore assist in the co-ordination of movements. If a muscle or group of muscles be deprived of their function, or even if their function be in part arrested, as in anterior polio-myelitis, deformities arise, and the joints become involved.

On the other hand, if a joint is diseased so as to interfere with and arrest muscular action, the nutrition of the muscle becomes faulty, and it undergoes a primary atrophic change (functional atrophy). These are merely passing remarks, but from the massage point of view they are of interest and importance; and they serve to explain to you, in part, why in massage processes I make it compulsory that every joint shall be manipulated and put through its normal movements before the muscles which control those movements are pinched and kneaded and masséed.

Every structure entering into the formation of a joint has its own special duty to perform. Each structure of which a joint is composed is liable to its own form of degenerative change, but all structures combine for the fulfilment of one definite end, namely, to maintain its integrity as a living organism. Covering the ends of bones we find a soft yielding membrane, the articular cartilage, with its smooth surfaces, which facilitates an easy gliding movement of one upon another, and tends to resist concussion and moderate shocks or impulses communicated to the bones. The joint is enclosed by the synovial membrane which, with the capsule to which it is adherent, forms a shut sac. The synovial membrane has the property of secreting a viscid, semi-fluid, colourless material, known as synovia, whose function is to moisten and to keep the joint lubricated, whilst the outer surface of the capsule is provided at various parts with bands of fibrous tissue, some of which strengthen it, whilst others restrain or limit the movements of the joint. Lastly, we have blood-vessels carrying the pabulum to nourish this structure, and the nerves to give to it sensibility, and to control its vascular supply, and special trophic nerves to regulate anabolic function. The movements in some cases are limited by special osseous development, but in the majority of instances by strong fibrous bands known as ligaments, which aid greatly in keeping the bones in apposition.

I have upon other occasions discussed with you the value, the importance, and the necessity of your making yourselves thoroughly acquainted with the normal appearance of every joint, and with its respective movements in every direction, so that I can pass these considerations by upon this occasion. The more movable a joint is the more liable it is to dislocation. The shoulder and the hip have the greatest tendency to this form of injury, whilst the wrist and the ankle are most subject to sprains. Again, the shoulder, the hip, and the knee respectively, are most frequently the seats of rheumatic pain, the hip and the knee are more prone than any other joints to be the seat of neuralgia, and the hip to arthritic and scrofulous degeneration.

You must know that joints, of all structures, are the most frequent seats of pain, either from injury or from atmospheric, gouty, or rheumatic influences, therefore it is natural to presume that massage will be called into requisition in the treatment of joint affections as much, if not more, than for any other disease; and this is only just and right, for I am perfectly convinced that we have no remedy of equal value. I am sorry that I have not time to give you the physiological reasons why this is the case. I am, however, sure that many stiff joints (not unfrequently the result of a too conservative treatment) might have been made adequately free to be serviceable if a system of massage had been carefully and judiciously carried out at a period sufficiently early. Nor can we be surprised that joints have fallen into the hands of quacks and illiterate impostors, and in many cases wonderful cures have been said to have been effected. I hope, and I believe, that as massage manipulations become better known and scientifically considered they will be adopted much more freely, and without bias, in the treatment of joints; so that in time the joint-man and the bone-setter will cease to have an existence. Every one must have heard of the supposed wonderful and miraculous cures made by these individuals. Some few years since I had a patient under my care suffering severely from an attack of rheumatic gout. I do not think I ever saw a worse case; muscles, joints and nerves were all involved. During convalescence the pain centred itself in one knee, and whilst examining this joint my patient exclaimed, "Leave it alone, pray; that is H——'s joint," mentioning the name of a well-known bone-setter. A few months after this the patient walked into my consulting room with his head fixed, so to speak, upon the shoulders; if he wanted to turn the head he was obliged to rotate the spine. After a few words he said, "I am going to H——; he cured my knee, and I mean him to have a go at my neck," and it was really some time before I could persuade him to allow me to break down the adhesions of the atlo-axoid joint. Of course this was readily effected by a quick and somewhat forcible bilateral jerk; yet after it was done he expressed himself more sorry than grateful that the joint-man had not been the operator. I need scarcely tell you that my fee was very small indeed in comparison to that which he would willingly have paid in the other direction; but there are ways, manners and means which at times baffle our understanding and defeat all rules of logic and sense.

Well, in the practice of massage you will meet with all kinds of joints—painful without swelling, and swelling with and without pain; joints with constant pain, joints with intermittent pain, joints where pressure relieves the pain, and those where pressure produces and intensifies the pain; sometimes associated with heat, sometimes with cold. Remember, if you please, that pain in a joint is more often relieved by extension than by flexion, therefore before flexing a painful joint grasp its proximal and distal ends *firmly*, draw, if I may so express it, the ends of the joint asunder, and then flex quickly or slowly according to circumstances.

It may be better for me to give you now some general indications in reference to "joint massage" before I proceed to inform you of the various conditions of joints which are specially benefited by this mode of treatment.

To massage a joint or to attempt any undue movement during the acute stage of inflammation would be unwise and improper, and if a joint is known to contain pus its liberation is necessary before any manipulations are commenced. Rest and extension are the true requirements for an acutely inflamed joint. Rest prevents the rubbing of one inflamed bone against another; and extension removes the injurious pressure which the inflamed articular surfaces exert upon each other from muscular contraction or weight. Before masséeing a joint after acute inflammation it is necessary to have some skilled surgical opinion. There is undoubtedly a stage after the more acute symptoms have subsided when absolute rest is positively harmful, for at this time the effused material if left alone rapidly becomes organized, and a stiff joint is sure to follow. It is at this period, or I may say at this juncture, that carefully applied massage and well-directed passive movements, not only frustrate organization, but bring about absorption and the healthy restoration of tissue. I need scarcely tell you that skill in these manipulations is absolutely essential, and the most delicate handling and watchfulness are called for. Slight elevation of the temperature indicates that extreme caution and care are required, and as long as the increased temperature persists the joint must be left alone. If, however, the temperature rapidly subsides the processes of massage may be resumed and followed up. It is not my practice to leave the joint for two or three days between the manipulations, for in this time organization may have produced very firm adhesions which, if broken down with any degree of force, must result in elevation of temperature; therefore, if you please, take *temperature as your guide for massage operations.* I have spoken to you of the necessary association of muscles with joints, and if a joint be acutely inflamed the surrounding tissues are also involved in the inflammatory process. These are the first to undergo repair, the tissues of the joint itself being last; therefore, the structures around the joint will invariably bear being manipulated a week or ten days before the joint itself, and in my opinion these ex-articular pressings and kneadings accelerate the reparative changes in the joint. We are led to this conclusion upon physiological grounds. John Hilton says, "The same nerve trunks whose branches supply the groups of muscles moving a joint, furnish also a distribution of nerves to the skin over the insertion of the same muscles, and the interior of the joint receives its nerves from the same source.

This implies an accurate and consentaneous physiological harmony in these various co-operating structures. Without this normal consentaneous muscular and sensitive function precision of action would be lost, and unnecessary exercise of muscular force would be employed during the performance of any of these functions."

We have seen that rest and extension are absolutely demanded for an acutely inflamed joint, but let us now conclude, once and for all, that the tissues around it will bear massage manipulations some ten days or a fortnight prior to operating in any way upon the joint itself. Of course I am now alluding to one in which an acute inflammation is subsiding, but not entirely subdued. In making these manipulations about joints I always advise the use of equal parts of castor oil and chloroform (to which I sometimes add the oleate of mercury), it prevents the chance of *jarring* the structures, and greater and firmer pressure (which is what we want) can be exercised by the use of this lubricant, and thereby unnecessary pain is avoided.

Now it is a question how much time should be spent over these manipulations in this *special stage of joint inflammation*, and I give you the following gradation: 1st, 2nd, and 3rd operation, five minutes; 4th, 5th, and 6th operation, ten minutes; 7th, 8th, 9th, 10th, 11th, and 12th operation, fifteen minutes; subsequent operations (if all goes well) thirty minutes. After twelve or eighteen operations, being guided by circumstances, you may commence *slight* flexion; in all probability if you try more you will find it impossible. Pray, do not try too much. You must treat the joint much in the same way that you would commence to feed a person after a continuous fast, or after hæmorrhage from the stomach. Very slight attempts at flexion every day will do much more than at first sight appears either probable or possible. In a little while, of course, the patient will be called upon to make voluntary effort, and it is surprising how rapidly after massage volitional efforts are brought into play, and how great is the general improvement which speedily follows. I advise you not to meddle with joints at night; always take the morning for your manipulations. I happen to have a case of chronic synovitis of the knee-joint in a patient otherwise nervous, and she is in attendance in order that I may demonstrate to you one or two points in reference to these massage movements. Effleurage and tapotement are out of the question altogether; petrissage movements alone are necessary, not so much in the pinching form, what we want is pressing and kneading; *well directed pressure, evenly, firmly, and gradually applied, must form the basis of our exercises.* My patient, now lying upon the couch, I place two pillows as you see at the back of the leg, and the knee is supported by the addition of a third. Lubricating my hands well with castor oil and chloroform, I place one firmly about six inches above the knee and the other six inches below it (*Fig.* 36).

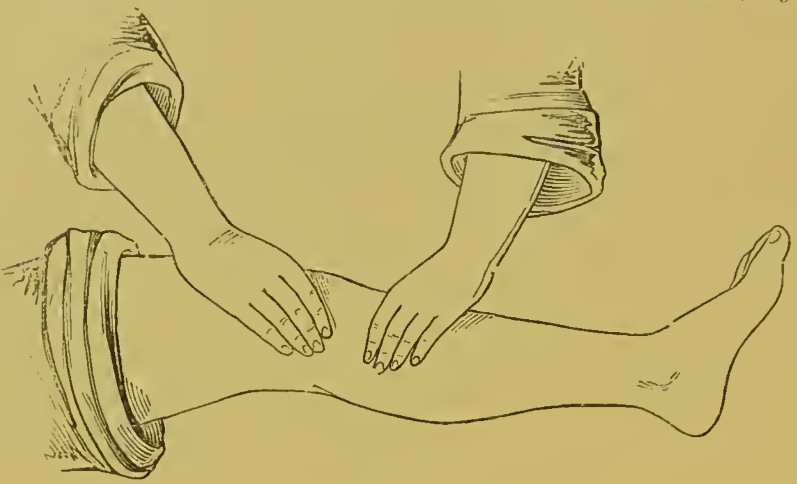


Fig. 36.

Making pressure, I advance my two hands, the one upwards, the other downwards, until they are within three inches of each other : I now suddenly remove my hands altogether. I repeat these operations very slowly and deliberately a dozen times, allowing an interval of about thirty seconds between them. My thumbs now become the executive with my fingers, or alone. For instance, you see I work my thumbs upwards on either side of the patella, or I place my fingers above the swelling and my thumbs below it, and very gradually, with as much pressure as my patient can bear, I bring them towards each other. When first operating upon a joint, two or three of these movements only are required. As we gain ground and the pain is lessened the movements are varied and localized with rotatory pressure over special points where we find the tissues to be thickened. We know by experience, to which I have called your attention before, how pressure produces absorption, even mechanical pressure. At one time I used to strap joints to bring about this result; now I never think of doing anything of the kind. There is no comparison between mobile pressure by massage and that produced by mechanical means: the former restores the absorptive power of lymphatics and veins, and at the same time their normal function and tonicity, so that the change brought about by massage is not only more effective but it is also permanent. With a little more experience, more faith in the massage treatment must result, and its general adoption will be ensured.

If I were inclined to rhapsody I should become so over the wonderful effects of massage in joint affections even more than in any other form of disease which I have brought under your notice. I can only say that in some cases I have been more than pleased, I have been fairly astonished at the results. Time is a necessary agent: the tendency of massage is to cure by the restoration of function in the part diseased, therefore the change must of necessity be gradual, though on this account it is all the more sure.

Sprains.—I must say a few words to you about sprains. Mr. Mansell Moullins has written a little handy and practical book about sprains, which ought to be read by those who are interested in this subject. There is a saying, which is by no means untrue, that "a bad sprain is worse than a broken bone." We can have degrees of sprains—slight and severe. As a rule the inflammation resulting from a sprain is primary to the weakness accompanied with pains which follow in the joint for a long time after the injury has been sustained. There are some sprains which are best treated by massage from the first, but if the injury be very severe, the part extremely inflamed and highly painful, it is wise to let the inflammatory stage pass by before massage is commenced.

Let me call your attention to a short paragraph in Mr. Moullins' little book at the commencement of chapter five, because it should be of interest to you. It relates to imperfect recovery from sprains, and reads as follows: "One of the most annoying things in connection with sprains is the frequency with which they improve up to a certain point and then come to an abrupt standstill. It is not merely that convalescence is protracted, it is delayed so long that it becomes a question if the joint is ever to recover. For the first few days, perhaps, everything progresses as well as it possibly can. The patient is wise enough to recognize the situation, and to reconcile himself to the necessary confinement, though this (as only those who have suffered themselves know) is very often far from being an easy matter. The dread of inflammation passes off, the swelling begins to diminish, the colour of the skin changes from black and purple to green and yellow, the tender points can be touched again and again, and a certain range of movement is permitted once more, though in a tentative and cautious manner. With moderate good fortune this continues until, at the end of two or three weeks, the injury is repaired and the joint as sound and as trustworthy as before. Very often, however, it happens as time goes on that the improvement becomes more and more slow, until perhaps it comes to an end altogether, and the joint is left stiff, painful it may be, and almost useless. The tissues seem to have been repaired, but freedom of movement does not return."

Let me add to these remarks of Mr. Moullin that the tissues do seem to, and apparently have been repaired, but this is not actually the case: neither the capsule nor the ligaments of the joint have regained their normal condition; their natural tonicity still remains decidedly at fault, and their nutrition is imperfect. So long as this is the case you may depend upon it that the joint itself is also imperfectly nourished, and in all probability slight adhesions exist in some parts, which are not fully recognised. In all such cases massage must be continued daily until the joint does become such as it was previous to the injury. I never hesitate when I have these conditions to deal with. Time and rest, and the ordinary rubbing with liniments, only make matters worse. I place the patient under chloroform, and I not only manipulate the joint freely, but I put the structures by extension movement fully upon the stretch in every direction. In some of these cases so operated upon the pain ceases and the joint by these means regains its function in a remarkably rapid manner. I cannot, for my part, understand why it is that massage is not resorted to more early in these joint cases; neither can I see why injuries to joints in strong healthy people, free from blood disease, should be boxed up until not only the joint itself becomes stiff but the muscles also are affected by the same cause: the enfeebled muscles are, of course, liable to contraction, and spasmodic efforts and cramps are by no means uncommon. I have spoken to you before of muscles enfeebled by disuse, so I shall deal with this matter now in a few words, though it might be made a very long tale.

Admitting that joints have trophic centres in the cervical and lumbar regions of the spinal cord, and that these centres are controlled by a higher centre in the medulla oblongata, which is very possible, but without proof, and that the trophic nerves pass with the motor nerve fibres, it certainly seems more than probable that the function of these nerves is arrested so long as a mobile joint remains immovable. Let me say again that the nutrition of a part is essentially bound up with its function, and that the function of a joint is movement; therefore I cannot bring myself to believe that prolonged rest is essential to anything other than anchylosis, and to the enfeeblement of intrinsic and extrinsic structures of the joints and of the muscles in association therewith. If the *normal* co-relationship or partnership between muscles and joints is severed entirely or in part, one must go to the wall, and the joint, being the least organized and the weaker of the two, it invariably suffers first and most. It may be the case that muscle wasting is primary and joint wasting secondary, as we find in some cases of deuteropathic muscular atrophy, but I should expect to find this from a physiological point of view. Charcot's joint disease is perhaps one of the most interesting of all forms of joint change, and from the result of its discussion at the Clinical Society in the year 1885, it would seem that its pathology in reference to causation has yet to be elucidated. It cannot be doubted, however, that it is a condition of wasting without repair, as pointed out by Mr. Baker. This is the rule, but even this has its exceptions, as referred to by Sir James Paget in some specimens shown by Mr. Barwell, though this does not detract from or invalidate the rule. Irritation of trophic centres by sympathy with changes in the posterior root zones of the spinal cord, is most likely to lead to malnutrition of those structures which have the lowest organization. Sir James Paget was, in my humble opinion, quite right when he said that, "Though rheumatic arthritis and the joint disease of locomotor ataxy could be broadly distinguished from one another, it was not fair to assume that there was in locomotor ataxy no measure whatever of rheumatic arthritis. It might well be a rheumatic arthritis modified by its coincidence with a disease of the spinal marrow, which hindered the ordinary, however ill-directed, processes of repair found in the ordinary rheumatic arthritis. The general feature of the most marked cases of locomotor ataxy was wasting, but all the cases of partial wasting with some new production of bone about the articular borders brought it so near to the characteristics of some of the cases of rheumatic arthritis that one could not doubt that there was a certain relation between the two."

It is quite clear that more extended comparative observations of joint changes and of other lowly organized structures in locomotor ataxy are necessary before a final solution of the question can be obtained. They cannot fairly be studied from advanced and very demonstrative specimens, they must be worked out from initial changes. If there is (and I believe that in reference to causation there is) some relationship between Charcot's disease and rheumatic arthritis, then comes the question to be answered, What is rheumatic arthritis? As all that I have to say in reference to this subject must be very brief, and what I do say is merely to draw your attention to these conditions for a purpose, I will refer at once to a very valuable paper on this subject by Dr. Archibald E. Garrod, read before the Medico-Chirurgical Society, in November, 1887, entitled "A Contribution to the Theory of the Nervous Origin of Rheumatoid Arthritis," and the arguments which he adduced were in support of the following propositions: (1,) That the causes of rheumatoid arthritis are such as might be expected to act upon the central nervous system; (2,) That the distribution of the lesions is such as would be likely to result from nervous lesions; (3,) That the distribution of the lesions is similar to that of certain arthropathics of spinal origin.

Dr. Garrod's views were supported by so careful and accurate an observer as Dr. Ord, who was of opinion that nervous influence had a great deal to do in the causation of this disease. He believed that nervous influence was reflected from the uterine organs to the spinal cord and on to the joints. He compared rheumatoid arthritis to progressive muscular atrophy. In a case of chronic cervical pachymeningitis there was much muscular and cutaneous wasting, and later on a remarkable degree of chronic osteo-arthritis developed itself. In another case of spinal injury joint trouble followed the muscular wasting after a long interval. At one time of my life, when I had more leisure for studying these cases, I was much interested in these conditions, but that opportunity is gone, and I therefore draw from the conclusions of others, which are as familiar to me as household words.

I mentioned that I had a purpose in bringing these conditions before you, and it is this, that treatment, to be of any use at all, must be early and active. It is generally admitted that the ordinary remedies are eminently unsatisfactory and do very little to check or retard the onward progress of the disease. I think it may be stated that the hands and knees are more frequently affected than other parts, but the hip is no uncommon seat of this affection. In an excellent article on rheumatoid arthritis by Dr. Bruce, in "Quain's Dictionary of Medicine," it is recommended to paint the joints with very strong iodine liniment, and to rub them with turpentine liniment. I must admit that I do not care for either the one or the other, particularly the strong iodine liniment. If local treatment is to be of any avail at all it is our massage manipulations combined with passive movements of the joints. I believe the effect of manipulations is considerably increased by the use of castor oil, chloroform and the oleate of mercury, at all events this is my experience. Now in addition to massage locally I have great faith in its application to the spine with the combined electric current, and if I were asked what I considered to be the best treatment for rheumatic arthritis, my answer would be, the actual cautery to the spine, the combined electric current and massage also to the spine, and local daily massage with joint movements.

I must not omit to tell you that I have great confidence in the massage bath for joints, and also the douching system which is so well carried out at Bath.

Mr. W. H. Freeman, the surgeon to the Bath United Hospital, has written an intensely interesting work entitled "The Thermal Baths of Bath, with the Aix Massage and Natural Vapour Treatment." Mr. Freeman did me the honour when I was at Bath last summer to personally show me all the bathing arrangements, and there is nothing in this country to be compared with them. In a short time, when complete, these baths will hold their own against any in Europe. Applications of massage and electricity with spray and with the hot water vapour are most thoroughly and efficiently carried out by experienced hands from the continent. It does seem strange that so handsome a city, with its famous Roman baths and its most valuable mineral waters rising from the earth at a temperature of 120° F., which were once sought after by the nobility of every country, should have sunk into disuse, and almost into neglect; but now a healthy reaction has taken place, and Bath will be itself again in a very short time. There is no reason why it should not become a great health resort. Nothing can surpass the new baths which have been and are still being erected under the very able supervision of Mr. Freeman.

The medical value of these waters, when taken internally and applied externally, combined with massage and electricity, is not as yet thoroughly known. There must be a great future for these forms of treatment in this grand old city. Bath is peculiarly adapted to the requirements of the gouty and the rheumatic invalid. There is in this city a quiet serenity and calmative influence, undisturbed by business turmoil and confusion which are sometimes disastrous to the cure of chronic invalidism; and I know that the Town Council, under the able guidance of Mr. Freeman, are determined to spare no expense or leave a stone unturned to make the sojourn of all those who seek the Bath cure in every way specially compatible with their requirements. The water when recently drawn from the springs is clear, colourless, and sparkling; in large quantities it presents a pale pea-green tint. It is free from any odour, and possesses a pungent, slightly saline and somewhat chalybeate taste, and though, perhaps, a little unpalatable at first, the invalid with whom it agrees comes to relish it, and even to desire it. If it were a little hotter it would be simply perfect. No chalybeate water should be swallowed hastily, it should be sipped down slowly, and for this reason I suggested to Mr. Freeman, and in my opinion with good judgment, that it should be diluted with plain hot water, so as to raise its temperature to 130° or 135° F., and the patient should then sip and swallow it gradually. These waters should be taken in this way early in the morning when the stomach is empty.

I have recommended several of my patients whom I have sent to Bath to adopt this method, and they have invariably borne testimony to the increased effects under such conditions. From the analysis of the water of the Bath Thermal Springs, one feels confident of their medicinal value. Fortunately, they do not contain an excess of any mineral ingredient, but they are rich in iron and alkaline salts, so essential to those who suffer from the impoverished blood and defective assimilation, to which so many of our joint troubles are really due. Dr. Macpherson, the author of the "Baths and Wells of Europe, and the Lime Sulphated Waters," bears the following valuable testimony to the efficacy of the Bath Waters: "Many complaints which were treated with great success in Bath have been remitted to similar baths upon the continent. Gradually, however, Bath has resumed its ancient repute. The most popular class of water abroad is that of Contrexèville, and this—although cold—presents a striking analogy in its chemical constituents to those of Bath, including its gases, especially the carbonic acid gas, and the same mildly exciting and stimulating effect is ascribed to the prudent drinking of both, and as the Contrexèville water is so celebrated in biliary and urinary concretions, so in Bath the mineral waters were formerly employed for the same diseases," and he particularly asks, "*Why should they not be used again?*"

Dr. Macpherson sums up by saying, "*What has been done in Bath can be done again.* The hotels in Bath are good; lodgings in the fine squares, parades, and crescents are equal to anything abroad; whilst many of the complaints sent to the continent could be treated just as well in Bath, where it is commonly desirable for these cases to remain in England; and, moreover, the waters can be drunk and the baths used all the year round." I can bear testimony, and it is my object to give testimony from personal knowledge and experience, to the truth of these statements of Dr. Macpherson. There are thousands of persons who can ill afford the expense, and to whom the journey is simply disastrous, who put themselves to great personal pain, discomfort, and inconvenience, to be treated at certain continental Spas, when they could be far better and even more successfully treated at Bath. On the other hand, those invalids who seek change, travel and excitement, and can get it to their heart's content, in a truly royal manner, at the fashionable European Spas,—are they the better for it?

After these rather discussive remarks about Bath, let me say a few words about swellings of the *Bursæ Mucosæ* and *Synovial Bursæ*. You will remember that when speaking to you of the anatomy of joints I called your attention to these structures. I told you that they consisted of spaces in the connective tissue, and that their walls were formed of this membrane covered by epithelium; that they contained a fluid in many respects analogous to synovial fluid, the use of which was to prevent undue friction when tendons glide over projecting bony surfaces; they form, in fact, simple or irregular cavities in the subcutaneous areolar tissue. For my purpose it is enough if I class these two forms of bursæ together. They exist in the neighbourhood of, and sometimes communicate with the cavities of joints, notably on the inner and lower part of the thigh, between the integument and front of the patella, over the olecranon malleoli, and other prominent parts. They are in direct communication with the lymphatics, and inflammatory products are absorbed from them with great readiness. These bursæ may be acutely inflamed, and extend to suppuration, as in housemaid's knee. But I am desirous to call your attention to what is usually designated *Dropsy of the Bursæ,* frequently of rheumatic or gouty origin. It usually consists of an accumulation of serous fluid which distends its walls and gives rise to considerable swelling. There may be both pain and tenderness, but this is exceptional. Yet, if these collections of fluid are permitted to remain without treatment, the result is that the walls become thickened, and then they are very difficult of cure, and sometimes, even when cured, they are liable to recur. As far as my experience goes, these swellings are less simple than they appear, and they do not readily yield to the counter-irritant treatment which is usually adopted. I allude to painting them with tincture of iodine, the application of blisters, setons, incision, drainage tubes, &c.

In my teachings to you relative to the effects of massage and electricity, I do not think that the greatest sceptic can accuse me of relegating to these modes of treatment a potency which I have not proved by experience and practice that they undoubtedly and unquestionably possess, and when I look back through the past at those cases in the treatment of which I have been unsuccessful, my only regret is that I was not at one time so conversant and familiar with these modes of treating disease as I have been during the later years of my professional life. If I told you that heterogeneous solid growths were to be dispersed by massage I should rightly and justly conclude that everything which I have said or shall have in the future to say relative to the potential value of massage would be treated with doubt, scepticism, and incredulity; but I have substantiated, and can give evidence and make good every and all claims which I have ever put forward in reference to this most valuable mode of treatment.

In bursal swellings, mucosal or synovial, massage is the remedy. The more recent they are the more rapidly do they yield. I have under my care at the present time a gentleman, naturally gouty, who suffers from these swellings at the lower and inner part of the thighs communicating with the knee joints. The latter are very little enlarged, but the swellings have extended to huge dimensions. They are slightly painful upon pressure, but he wakes every morning on account of the dull, aching, wearying, and, as he calls it, sickening pain which they cause him; no doubt this pain is due to the tension and pressure exerted upon surrounding structures. This is the third time that he has suffered from them, and in each case they have been associated with gouty and dyspeptic symptoms, but they have readily yielded to careful and well directed massage manipulations. In other, but similar conditions, my masseurs have met with the same success. I can only maintain that these results are extremely gratifying, and such proofs cannot be conscientiously ignored or set aside. Some surgeons have said to me, "It's all very well, but any treatment will cure certain cases, or no treatment at all. I'll give you a case, and see where your massage will be." I am quite open to receive such cases and put them to the test, but I will first exercise my judgment upon them and base my verdict as to the result according to their nature.

Stiff Joints—Rheumatic and Gouty Joints.—Joints become stiff from disuse, from acute inflammation, or from sub-acute and chronic inflammation. The most common form of stiff joint is from disuse, with co-existent disuse of muscles. Take a case of Collis' fracture; it is common after a month's incarceration of the forearm and hand to find the wrist and finger joints almost immovable. Here we have stiffness from mere restraint of function, and it may be three weeks or three months before normal mobility is restored; the muscles and joints have to re-adapt themselves to their lost harmonious co-relationship. Again, we will take a case of suppurative inflammation of the knee-joint. During the acute stage and that of suppuration rest is not only essential but compulsory, the acute pain of the joint, independently of the will of the patient, inhibits the sub-conscious automatic functional activity both of joints and muscles, and it is of little consequence whether the limb is restrained or not, movement is arrested, unless it be of a spasmodic or jerky character; extension of the foot and counter-extension at the hip are alone required. If my knowledge of these conditions is of any value, let me advise you never to incarcerate either muscles or joints. Give your muscles liberty of action, as far as it is reasonable and compatible with physiological rest, and in the case of joints, let your great consideration be restoration of function. I may be wrong, nevertheless it is my opinion, that too great conservative action on the part of the surgeon in reference to joints, is unsound in principle, and opposed to all laws of physiology and common sense. It has established impostors, charlatans, and quacks, when such as those could never have existed if massage and mechano-therapy had not been considered a violation of the system of so-called scientific canonization. We know quite well that massage will not break down adhesions, but we do not as yet know, and we have no laws to guide us, when an attempt should be or should not be made to break them down in a very large number of cases. But the consideration of this subject in its entirety is not within the scope of my lecture, although I could say very much about it.

Now massage in *all* rheumatic and gouty affections is of the utmost value, whether they be of muscles or of joints; and if it be adopted, as it should be, at an early stage, much misery and pain will be averted, and many a useless limb will be made whole and sound.

Lecture XII.

MASSAGE IN SLEEPLESSNESS, PAIN, DIPSOMANIA, MORPHIOMANIA, AND MELANCHOLIA.

The value of Massage in these troublesome conditions, rousing dormant faculties, preventing and subduing unnatural habits, restoring tone, strength and failure of resisting power—Carpenter on Mental Physiology—Its moral nature—The normal Relationship of Mind and Body—Hereditary transmission of acquired habits—A sub-conscious state apart from the Moral, Mental, and Psychical states—Bain on Mind and Body—Sleeplessness—Causes of sleeplessness—Result of sleeplessness—Influence of Massage in producing sleep—The attributes of the Masseur, and some conditions relating to the patient—Massage manipulations of the head detailed—Pain a common sensation—Ideal pain—Pains of Locomotor Ataxy treated by Massage and Galvanism—Ferrier on pleasure and pain—Meynert on pain and feeling—Dipsomania—Morphiomania—Melancholia.

To-day I have to speak to you upon subjects relating to the known as well as to the unknown subjects which are within the comprehension of man up to a given standard, but over this point it is beyond the human mind to do more than theorize, and at the best our conclusions are vague, uncertain, and obscure. I allude to the inner consciousness of man. Dr. Carpenter, in his work on "Mental Physiology," says, "To whatever extent we may be ready to admit the dependence of our mental operations upon the organization and functional activity of our nervous system, we must also admit that there is *something beyond and above* all this, to which, in the fully developed, self-regulated intellect that activity is subordinated, whilst in rudely trampling on the noblest conceptions of our moral nature as mere delusions, the purely materialistic hypothesis is so thoroughly repugnant to the intuitive convictions of mankind in general, that those who really experience these are made to *feel* its fallacy with a certainty that renders logical proof unnecessary."

Unquestionably the normal relationship of mind and body is co-existent with a self-determining power which adapts itself to its specialized environment, and which can rise above all the prompting of *suggestion*, mould itself to external circumstances, to its requirements, and to that which is best and noblest and purest in life. Is this correlative integrity of mind and body the habitual and fundamental part of human nature? For myself, I can scarcely realize it, and it must be admitted that the *material world outside ourselves* must govern and act reciprocally with a *self-determining power within ourselves;* though the faculty of appreciation and perception and reasoning must be in direct relationship with the integrity of our physical organization. Retinal defects will lead to a perversion of *colour perception;* we derive our notion of *solid form* by a process of *mental construction* which may be materially altered by some visual defect.

All the phenomena which evidence the influence of the body on the mind, of physical upon psychical states, demonstrate in a marked manner how the metaphysical part of our nature must be influenced by the physical. The normal activity of the mind is dependent upon the due supply of healthy pabulum to nourish the brain, and defects in mental processes can frequently be traced to poisonous material received from without, and generated within ourselves, having marked effect upon our *volitional control* and ideation. Hereditary transmission of *acquired habits* which have modified the bodily constitution of the parent repeat themselves in the offspring, but this reproduction of the parental model may be attended with considerable variation. This is not only delineated in character and temperament, vices and virtues, but also, as Sir James Paget has pointed out, "the formative power is often exercised, not only in maintaining the original type, but also in keeping up some acquired peculiarity, as for example, in the perpetuation of the scar left after the healing of a wound."

The physiology of habit is intimately associated with our being, and becomes part of our being, and may be counted among the psychical principles of association. Unfortunately, in bad as well as in good habits, the sequence of mental action which has been frequently repeated tends to perpetuate itself, so that we find ourselves automatically prompted to *think, feel* or *do* what we have been before accustomed to think, *feel* or *do* under like circumstances, without any consciously formed purpose or anticipation of results. Habit must be an inductive process generated within ourselves, and by ourselves, but not necessarily of ourselves; yet how often is it superior to ourselves, even in spite of intense volitional effort to counteract it. The dipsomaniac can verify the truth of this statement. There is a subconscious state in our existence (apart from the moral, mental, or psychical), distinct altogether from what we know as our conscious ego, and which we may term our unconscious ego; it is in direct continuity and relationship with our organic or inner life, just as our conscious ego is in direct relationship with our volitional or outer life. Both are alike acted upon and impressed by surrounding media, but there is this difference, that in the former we are only made aware of its existence by effects, the impress is to us unknown, whilst in the latter the impress is recognized and becomes converted into a conscious volitional experience. And again, the former may produce physical or psychical disturbance, or both, just in the same way as the latter. It is quite possible that some may call this disease: I have no objection to this, but it must receive due recognition if we are to comprehend, only in part, many of the obscure phenomena of undefined nervous states, of which there are not a few.

I will now quote to you a passage from Prof. Bain's work on "Mind and Body"; I shall then place you in a position to follow some of my simple ideas concerning the conditions we are about to discuss. "We have every reason for believing that there is in company with all our mental processes an unbroken material succession. From the ingress of a sensation to the outgoing responses in action the mental succession is not for an instant dissevered from a physical succession. A new prospect bursts upon the view; there is a mental result of sensation, emotion, thought, terminating in outward display of speech or gesture. Parallel to this mental series is the physical series of facts, the successive agitation of the physical organs. . . . While we go the round of the mental circle of sensation, emotion, and thought, there is an unbroken physical circle of effects. It would be incompatible with everything we know of cerebral action to suppose that the physical chain ends abruptly in a physical void occupied by an immaterial substance, which immaterial substance, after working alone, imparts its results to the other edge of the physical break, and determines the active response—two shores of the material with an intervening ocean of the immaterial. There is, in fact, no rupture of nervous continuity. The only tenable supposition is that mental and physical proceed together as undivided twins. When, therefore, we speak of a mental cause, a mental agency, we have always a *two-sided cause*, the effect produced is not the effect of mind alone, but of mind in company with body."

Sleeplessness may be truly defined as an infirmity. It grows surely and unconsciously by habit; it becomes aggravated and increased by continuance; it is the precursor of the most serious consequences; it is invariably associated with an irritable, excitable, overtaxed condition of the brain; it denotes a laxity of the cerebral vessels, and a sluggishness of the cerebral circulation; it is an unnatural and abnormal perversion of one of the grandest of nature's laws. Rest of mind and body by sleep, untrammelled sleep, is essential to the due performance of both mental and bodily labour, and to the physical and mental well-being of man. The chief cause of sleeplessness is an irritable state of the brain and its vascular supply. The sleepless brain is almost invariably an over-taxed brain: a brain may be unconsciously as well as consciously over-taxed. It is a question how far nutritional changes take place in the brain during sleep. There can be little doubt that in sleep potential energy accumulates, and the freshness and vigour of body, the clearness, brightness, and activity of intellect after a good night's rest are indicative of power and capacity for work which did not exist previously. In health, fatigue and sleep go hand in hand, but even in health one finds sometimes that over-fatigue from too great muscular exercise tends to an irritable state of the brain and sleeplessness, and this is usually attended with some amount of mental excitement. There are degrees of sleeplessness: sleep pure and unadulterated is free from dreams and bodily irritability. Some people apparently sleep all night, but the brain is in a state of fitful wakefulness, and this is perhaps more harmful than no sleep; others, again, will go to bed feeling thoroughly tired, wearied, and exhausted, but in the course of two or three hours awake, and, do what they will, sleep does not return: this is the most common form of sleeplessness. Sleep begets sleep, and wakefulness begets wakefulness. Ordinary *profound* sleep indicates a *suspension of sensorial* activity, but the spinal cord in relation with the sympathetic system of nerves, and their ganglionic reflex communications are ever in a state of responsive and unwearying normal excitation. All reflex movements necessary to the maintenance of organic life can be excited by appropriate stimuli, and even ordinary volitional movements can be stimulated into reflex action without the conscious ego being aroused. Dr. Carpenter gives the following amusing and, to us, instructive story in relation to this. "It is said that the Dacoits, or professional thieves of India, have been known to steal a mattress from beneath a sleeper by taking advantage of this tendency. They begin with *intensifying* his sleep by *gently fanning his face*, and then, when they judge him to be in a state of profound insensibility, they gently tickle whatever part of his body may lie most conveniently for that purpose. The sleeper, withdrawing himself from this irritation towards the edge of the mattress, the thief again fans his face for a while and repeats the tickling, which causes a further movement, and at last the sleeper edges himself off the mattress with which the thief makes away."

It is interesting to note the requirements of different individuals with regard to sleep: some people seem to require a great deal, others can do with a very little. I am quite sure that too much bed, if not too much sleep, is prejudicial, though a certain amount is absolutely necessary.

The brain itself, no doubt, is essentially at fault in some forms of sleeplessness, the causes being chiefly worry, anxiety, trouble, over-work and mental distress. But these causes in time pass away and still the sleeplessness continues: the brain has got into *the habit* of wakefulness, and the nervous system is irritable in consequence. Sleeplessness for a time may be attended with an increase of brain power due to a sthenic condition of its circulation, but the break-down, when it comes, is in some cases simply disastrous, and partial or total failure of the intellectual and reasoning power may be the result.

There are people who can will themselves to sleep. This power has been ascribed to great generals, such as Wellington and Napoleon. Others, again, are said to have the power to will themselves not to sleep. For my own part, I scarcely know which is the more difficult, but this I do know, that it is a comparatively easy matter to get a patient to sleep by massage manipulations, in fact much more easy than to keep a patient awake who is *dead beat.*

It is astonishing what slight influences will often bring about or retard sleep. Every one knows the influence of habit, not only in regard to time, but also as to place and circumstances, in predisposing to sleep. It is related of the Abbé Faria who acquired notoriety through his power of inducing somnambulism, that he was accustomed merely to place his patient in an arm chair, and then, after telling him to shut his eyes and collect himself, to pronounce in a strong voice and imperative tone the word "dormez," which was usually successful. Dr. Carpenter states, "It is one of the most curious phenomena of the 'biological' state, that in many subjects, at least, sleep may be induced in a minute or less, by the positive assurance with which the mind of the individual becomes possessed that it *will* and *must* supervene." I had a curious but not uncommon instance of this in a patient only a fortnight ago. He was complaining sadly of want of sleep. After the night's massage he went to sleep comfortably for two or three hours, but then awoke, and remained awake for some hours. Although he tried and tried to go to sleep, his own will and determination were of no avail. He would not take opium, chloral, or belladonna; he had taken bromide of potass in large doses, but it had no effect. I prescribed for him a draught of which he agreed not to know the composition: it contained only ten grains of bromide and a little alkali, but I assured him it would give him sleep, and my only fear was that he would sleep too much. This gentleman, after being massaged, took his draught and slept with only one slight intermission for fourteen hours. His fire was lighted as usual at seven o'clock in the morning without in any way disturbing his slumbers, and at eleven o'clock when his masseur waited upon him he had to leave, because his patient was still sleeping soundly. I might say I had the entire confidence of my patient, and when I told him in a very decided way that he could not fail to sleep, I have every reason to think that he thoroughly believed me.

The psychology of sleep is a deeply interesting study, but it leads us into a vast field of thought about which there is so much that is ambiguous, delusive and hypothetical, that I think we had better leave it alone; at all events, it is not within my present range of thought or diction.

The question, however, which concerns us, is this: Have we in massage an agent which, as a rule, will so far act upon and suspend or inhibit sensorial activity in our patients as to induce sleep? And if so, to what part of the body are our manipulations to be applied? And in what are those manipulations to consist? I do not think that any person to whom massage has been administered can for a moment doubt its soothing and calmative influence. This should be the first effect of our efforts, we cannot hope to induce sleep if we are unable to tranquillize, calm, and soothe. It sometimes happens that our manipulations produce irritability rather than composure, but this is not usually the case. I am willing to admit that many otherwise excellent masseurs are quite unfitted for this task; it requires and demands a special organization, a lightness of touch, a sense of confidence, and an assurance of results, which all do not possess. The character of the masseur must be imbued with motive, induction, persuasion, solicitation, encouragement and inspiration; the power of control, restraint, and authority must be so exercised with purposiveness and intenseness that the patient is made aware of his influence and yields himself to his treatment with a spirit of obedience, subjection, and unswerving trust.

You will not unfrequently find that patients suffering from *nervous sleeplessness*, which is the most common form, will have their novels by their bedside, their heating apparatus at hand for warming beef tea, their dressing gown and their slippers placed conveniently for them to get up and walk about, and everything in fact arranged by their anxious friends to while away the dreary hours of night. All these must be removed. Ascertain exactly the precise position in which the patient lies; see that the feet are to the south and the head to the north; and under any circumstances have the bed freshly made, and the pillows arranged quite in accordance with the patient's desires. Ensure the offices of nature being duly performed, and place a hot water bottle at the foot of the bed, extinguish all gas lights, and have one candle *only* burning, and if the fire is blazing damp it down. Now make sure that your patient's feet and legs are warm and, if necessary, let the lower half of the bed-clothes consist of flannel (nine-tenths of the sleeplessness is created, maintained and supported by defective circulation in the lower limbs); at all events, do not think that you are going to compose your patient into sleep until you have made *the legs warm below the knees.* If need be, they must be well massaged, but you know I recommend, as a rule, the lower extremities, buttocks and abdomen, to be manipulated in the morning, and the upper extremities, spine, head, and neck, at night. But please to remember there are no rules without exceptions, and that I am now telling you what, in my experience, I have found best to do for *nervous sleeplessness.* Well, having thus far completed your arrangements, turn your patient over towards the side and manipulate the spine by effleurage movements for about five minutes, then take the arms and serve them in the same way; if the patient moves hurriedly, check her or him at once. *Enjoin absolute silence.* Then you should make the patient take one dozen slow, prolonged inspirations with the mouth closed, and let the arms lie loosely upon the fore part of the body; and now, after having arranged the bedclothes with due consideration, you commence to massage the head, the forehead, the eyes, and behind the ears.

I called your attention to these manipulations in my second lecture, but I will briefly allude to them again, particularly in reference to the induction of sleep. Pass your extended fingers over the forehead upwards and through the hair (making the patient close the eyes and keep them closed) lightly, softly, but effectively: repeat these movements twenty, thirty, or forty times, according to the circumstances of the case; you can never hope to be successful unless you acquire the habit of thinking and judging for yourselves. Now place your thumbs upon the nasal eminence, and carry each respectively upwards and outwards over the frontal eminences, say twenty times. These movements should be performed with a slight degree of pressure, but very slowly and deliberately; now carry your thumbs, commencing from the nasal eminence, along the superciliary ridges above the eyebrows to the external angular processes of the frontal bone; after this, place the thumbs just above the internal angular processes, and with very light, very slow movements pass over the eyes to the external angular processes; next carry your thumbs from the internal angular process downwards and outwards over the cheek beneath the malar bone; last, but by no means least, place your fingers behind the ears, over the superior portion of the mastoid process of the temporal bone, and draw them lightly over this process, to the angle of the jaws around their rami to the mental eminence.

I have given you as good a description as I can well do, and now, if you will watch me carefully, I will go through these movements upon this patient so that you may not only see and judge for yourselves, but practice with a determination and will to learn. At all events, I shall expect you to acquit yourselves creditably when I come to test your capability. You know I cannot make you massage, I can only direct and show you how these manipulations are best performed.

I need scarcely tell you that massage for sleeplessness should be carried out at night, the later (in reason) the better. I know of no other application of massage so interesting in its results as this. Many times have I left patients in the sweetest of profound slumbers, after carrying out the manipulations which I have just briefly portrayed. I hope that I have made this form of massage quite clear to you, as I have endeavoured to give a somewhat detailed account, not only of the manipulations themselves, but of other points of importance relative to certain adjuncts, which, trifling as they appear, are nevertheless of consequence. Upon another occasion I will give you some curious particulars of cases of sleeplessness which have come under my care, and which have been treated by massage. But I must now pass on to the consideration of massage for the relief of pain.

Pain.—With reference to pain, let me first tell you, by way of repetition, that the first duty of the masseur is to relieve it and never to inflict it unnecessarily. What is pain? We must endeavour to know something about it, and we shall then be in a better position to cure it. I have told you that the nervous system of man is made up of specialized material having correlative functions, forms of force—sentient, motor, ideational, of which mind is the evolutional outcome. As pain is a common sensation, we know that it is associated with the sensory and sentient part of our being. If the sentient channels are destroyed by inhibition or disease, the sensorium is incapable of receiving by impression that (whatever it may be) which gives rise to the sense of either pain or pleasure. A blind man cannot appreciate in the ordinary way and derive pleasure from an Alpine sunset, but it may be graphically described to him, and the *ideal* impress which is thus conveyed to his brain elicits an unquestionable acknowledgment of the sense of pleasure. Neither can he witness some tragic occurrence, but this, in like manner, may be made known to him, and it also excites the sense of most painful anguish. Therefore from this reasoning I think we may fairly conclude that both pleasure and pain have an ideal side: we know they have a moral aspect.

A man known to suffer from an attack of asthma, when a cat was in the room where he was sitting, upon hearing somebody remark that a cat had come in (when such was not the case) was seized with a paroxysm, and nothing could persuade him that no such animal had been there. This was the result of ideation.

I merely draw your attention to this to show you that there is an ideal side to sensory impressions. It is far too long a story to go into carefully, therefore ideal, or, if you will, imaginative pain is frequently as real to the patient as though some excitation to a sensory nerve actually existed. When the excitability of the nerves which administer to painful impressions is increased, a slight touch of the skin or a breath of cold air may excite the most violent pain. We all know how pain is connected with inflammation, and even defects of nutrition. The intensity of pain depends upon the excitability of the sensory nerves, the larger the number of fibres affected the more severe the pain. Pain is rarely continuous for any great length of time, it has, particularly in some forms of neuralgia, its periods of exacerbation and diminution. You know how in some forms of neuralgia, particularly of the eye and the brow, it will come on daily almost to a minute, take a definite time to reach its pitch of intensity, and then decline, so that its periods in reference to time can be easily calculated. The pains sometimes associated with posterior spinal sclerosis are very peculiar and very erratic; they come as quick as lightning, and disappear in the same rapid manner, and when the pain is at its height, it may be suddenly forgotten by something attracting the attention of the patient.

The pains of locomotor ataxy are worth considering, especially in reference to treatment by massage and galvanism, for the reason that they are scarcely influenced by drugs or ordinary external remedies. They may occur in any part of the body, but their most frequent seat is in the legs. They rarely correspond to the trunk of a nerve, but are usually located within a limited area, particularly of the skin, although they may extend to the deeper parts. They are often described as lancinating, stabbing, burning, tearing and gnawing, and it is their nature to come on quite suddenly. They may last for three or four days. These pains, however, are not always of such an acute character: they may be dull, aching, and diffuse, resembling the pains of rheumatism, for which they are sometimes mistaken, and like the pains known as rheumatic, they may be influenced by change in atmospheric conditions. I am bound to admit that I have tried almost every drug for the relief of these pains, both externally and internally, without any appreciable advantage; but for the past three years I have, both in hospital and private practice, obtained great relief, and in some cases a cure for them by massage and the continuous galvanic current. In more than one case I remember to have removed them by charging the patient with static electricity and making the point of discharge immediately over the painful part; but now my common practice, and one which I invariably adopt with decidedly satisfactory results, is to attach to the spine a long sponge electrode (anode) and make a strong hot salt water foot-bath (kathode), alternating the current about once in three minutes. The greatest strength of current which I ever employ does not exceed ten milliampères in strength. I have tried the combined current in this way, but, from my experience, the voltaic current alone is much more beneficial.

To revert to the nature of pain, we may say that it is a message of suffering sent from an injured part through a chain of nerve elements, as a message of word symbols is transmitted by a telegraph wire. The purpose of pain may be looked upon as protective. The sensation is the warning sign of injury, and cries for relief, not simply for the avoidance of suffering, but for the remedy of a state or condition which threatens the integrity of the tissue or organ in distress. It is in this light that pain should be regarded. It may be heroic to bear necessary pain, but to turn a deaf ear to its warning cry is to commit an act of folly. Meynert says, "Pain is classified with the *feelings*, but it is distinguished from sensory perceptions by its widespread irradiation which interferes with localization. Feelings without physical pain are termed *emotions*. Emotion being expressive of psychical pain." I think Ferrier puts this very clearly in his work on "The functions of the brain." "Sensations are accompanied in consciousness by *feelings* which are divisible into two great classes—Pains and Pleasures. Just as sensations are the subjective side of certain physical modifications of the nerves and nerve centres, so pleasurable or painful sensations may be regarded as the subjective expression of physical harmony or disharmony between the organism and the influences acting upon it. A painful sensation is a physiological discord incompatible with health or comfort, a pleasurable sensation is a physiological harmony promoting health and comfort." Bain expresses this fact as the law of self-conservation: "States of pleasure are connected with an increase, states of pain are connected with an abatement of some or all of the vital functions. We know that abstraction from existing pain lessens its quality and its intensity as evidenced in great writers and great lecturers." It is said of Sir Walter Scott when writing the Bride of Lammermoor, that although the subject at this time of severe pain he was often relieved of it by intensity of mental ideation.

Having made ourselves somewhat conversant with the nature of pain, and knowing that pain is the result of some physical disruptive influence acting upon the sensory and sensorial side of our being, and also knowing that according to the perception of an impression, and the manner in which the impress is received by the sensorium, we have pains varying in distribution, character, and intensity, let us consider very briefly the different kinds of massage which we find most useful for different kinds of pain. Broadly speaking, we have defined effleurage movements as being specially applicable to the head and body surface; petrissage movements to the deep-seated muscles of the extremities; tapotement movements to the back, loins, buttocks, and masses of muscle wherever situated. By way of demonstration let us take a painful and irritable ovary. The patient dreads having the parts touched on account of the pain which the pressure exercises, or seems to her to exercise, and do what you will, unless you are very clever, you cannot convince her to the contrary. Let your manipulations in a case of this sort be of the most gentle and soothing kind, very superficial, and rather away from the tender spot: after a short time you will find that you have got over one stage of the difficulty, and then your manipulations can be gradually made as deep as you please. In the pain of lumbago, if you wish your massage manipulations to be curative, you must work deeply into the muscles by both petrissage and tapotement. The coarser the texture of the structure to be massaged, the coarser the form of massage manipulation is required. For the relief of pain we have to consider at least two very important points, whether we attack it locally, or whether we destroy the perceptive nature of the sensorium upon which the impress is made. If we put a patient to sleep by opium he is oblivious to pain: the pain is still there, but he feels it not: after the patient awakes, the sensibility of the sensorium returns and the pain is again perceived. Therefore, as we know that pain must be of the head as well as of the part where it originates or is located, no matter to what part it is referred, we recommend the painful part to be massaged, and the head as well. If pain will keep (as it so frequently does) a patient from sleeping, it is sometimes more necessary to procure sleep to relieve pain than it is to relieve pain to procure sleep. If the pain be due to some internal disease, to which local massage cannot be well applied, masséeing the head will frequently soothe, comfort and relieve pain, although it does not produce actual sleep.

You will not unfrequently find that the more severe and rapid the manipulations the greater relief to pain they afford; the sensibility of the part undergoes momentary excitability and then sinks into a state of analgæsia. The spine is more frequently the seat of hysterical pain than the knee or hip-joint. If you have a case of painful spine of hysterical origin to treat, you must work at it lightly at first, then you may gradually increase your pressure. In all parts the seat of acute pain, if you cannot reconcile the patient to submit to treatment, use an application of hot vinegar and water, or hot water alone, by means of a sponge; it must be kept to the part for three or four minutes, and then re-applied, if necessary, until the acute sense of pain is diminished, when any form of manipulation can usually be tolerated. Strain, stress and pressure are frequent causes of local pain, and strain, stress and pressure by massage are necessary to counteract these conditions. I have already, I think, drawn your attention to the various applications of massage to every part of the body for the relief of pain and otherwise, and you know I am always very glad to make clear to you any point with which you do not feel thoroughly conversant, but massage in all forms of pain is of great interest from the mental as well as from the physical aspect.

I believe, but as yet I have failed to get much information upon the subject, that in dipsomania and morphiomania massage should be of very great value. Thanks to men like B. W. Richardson, Norman Kew and others, we know more of the essential nature of dipsomania and morphiomania than we at one time did, but these and other forms of so-called mania give evidence of an associated weakness of the physical and moral side of human nature which can be neither weighed nor measured, nor even located in the cerebral substance. The causes of mania must be evolved in the study of psychology, and the underlying nature of psychology can only be evolved by a careful analysis of clinical phenomena from which are to be gathered the fundamental facts upon which these phenomena are based. Morbid symptoms are not recognized by their scientific substratum, but in studying this substratum we are actuated by the desire to fathom the phenomena of disease. Manias must be looked upon as psychical functional disease; by this we mean a deficiency in the normal development or arrangement, hereditary or acquired, of the normal attributes of the psychical side of man's nature. Crichton Browne, writing on mania in "Brain," advocates "the more minute study of the symptoms of mania with a view to determining with more or less precision the position of the brain lesions upon which mental disease depends." This, however, is a pathological problem for future enquiry and research. We know a great deal, and our knowledge of the effects of alcohol upon the nervous system and of the tissues in general, is gradually being developed, still it is a question as to how far alcohol is really the cause of much tissue degenerative change which is attributed to it. Sir James Paget has stated that it is a point for serious consideration whether the alcohol is more to blame than the deleterious material with which both wines and spirits are adulterated, and Dr. Dickinson, in the discussion upon tissue changes due to alcohol, now going on at the Pathological Society, stated that we have to consider whether some of the effects of alcohol are not really regenerative as well as destructive.

I have long maintained that in destructive changes of the spinal cord alcohol not only retards degenerative changes in the nervous tissue, but aids very greatly in the building up of compensatory material. The moral effects of dipsomania are so well known and so deplorable that I need not allude to them. There can be no question of doubt that if alcohol were banished from the face of the earth we should be a far happier and more powerful race. It is one, but only one of the many scourges afflicting mankind. The term inebriety is unsatisfactory, dipsomania is comprehensive. Any human being who loses self-control (it does not matter from what cause) becomes the creature of impulse, loses stability and resisting power, is incapable of reason and human judgment, and, whilst this is the case, such person is in every sense of the word an irresponsible and maniacal entity. Dr. W. A. F. Browne, when the first Medical Lunacy Commissioner for Scotland, stated, "The drunkard not only injures and enfeebles his own nervous system, but entails mental disease upon his family. His daughters are nervous and hysterical, his sons are weak, wayward, and eccentric, and sink under the pressure of excitement of some unforeseen exigency or the ordinary calls of duty." The experience of those who, like Hartley Coleridge, have inherited the craving for alcoholic excitement, together with the weakness of *will* which makes them powerless to resist it, whilst all their better nature prompts the struggle, must satisfy anyone who carefully weighs it, how closely connected their psychical state is with the physical constitution which they inherit, and how small is their own moral responsibility for errors which are mainly attributable to the faults of their progenitors. Dr. Carpenter, in his work on "Mental Physiology," in writing of intoxication and delirium, says, "There is no class of aberrant mental phenomena which is more deserving of careful scientific study than that which is produced by the introduction into the blood of substances which are foreign to its composition, and which have the special property of perverting its normal action upon the brain."

If one contrasts the brain of the dipsomaniac when free from alcohol, full of intellect, reason, and judgment, with a disposition loving, kind, and genial, with a heart responsive to all that is disinterested and truly noble, and compares it with the brain under the influence of alcohol, the change seems scarcely credible. In the latter condition we have a being destitute of humanity, regardless of past, present, or future, abandoned to vices which to him under ordinary circumstances are disgusting and repulsive; indifferent to those whom he ought to cherish, love, honour, and regard; careless of himself, his habits, his associations, and acquaintances; the dupe and the prey of all about him; fickle as the wind, faithless as the brute, steadfastness and volition and will power absolutely gone, as instanced by a weakness and vacillation deplorable and pitiable to witness. We cannot say that there is much difference between this form of brain and that of the morphiomaniac, in each there is loss of that which constitutes humanity—"will power and resisting power." In both conditions the cause is physical, but the ultimate effects are psychical. We have to deal, then, essentially with a psycho-physical element which gives rise to a craving for alcohol or morphia, producing an unquenchable desire for a poison, over which the unhappy individual has no control.

A patient who was once under my care, full of religious instincts and intellectual activity, said to me, "Doctor, when this craving for drink comes over me, I feel myself in an atmosphere which can be none other than that of hell. I am tempted by an unseen agency, my inner consciousness of wrong writhes in mental agony, I even pray that I might be delivered from this devilish temptation, but my will goes and I am drawn imperceptibly into the arms of my most detested, hateful, and degrading foe."

There is unquestionably a remarkably close affinity between dipsomania and other states of insanity. The power of volitional control is easily overcome, being at the best of times very feeble. It is sometimes surprising to witness how a small quantity of alcohol will upset the normal balance of power, and lead to mental disturbances truly astonishing; even conditions of monomania have been induced under such circumstances. It is certainly quite true that the craving for stimulants and sedatives is associated with those who are unfortunately born with an ill-balanced nervous system. I know this might mean anything or nothing, but there is such a condition as *physical craving*, without any direct propensity, which is found to be relieved by alcohol, chlorodyne, or morphia, when a propensity becomes established and culminates eventually in a mania.

No one can doubt the vast good which the present wave of temperance has produced in this country; the *habit* for drink has been checked, and let us hope that in time inebriety as a disease may become extinguished. Dr. Crothers, Superintendent of Walnut Lodge Asylum, Hartford, Connecticut, writes very practically upon the disease of inebriety and its treatment ("Lancet," November 19th, 1887). In speaking of intemperance waves, he says, "The evidence is steadily accumulating, pointing out these great drink cycles, which like storms gather and increase up to a certain period and then die away. The great unknown forces and laws which regulate these drink epidemics await discovery. When they are known, then much of the mystery of the strange temperance revivals and agitations which spring up and sweep over the land, dying away as suddenly as they appear, will be cleared away." "Temperance agitations have a strange wave-like movement evidently controlled by laws unknown." Let me say that my experience of massage in these cases is not sufficiently extensive to warrant my advocating it, but from the definite action of this mode of treatment, I can but think and believe that it should be of great utility.

I hope soon to hear that a system of massage with galvanism is being carried out in inebriate homes, where every opportunity is offered to put its influence to a fair and impartial test. I feel quite certain that in cases of morphia craving it can but be useful. Dr. Oscar Jennings, of Paris, has written in the "Lancet" of June 25th, 1887, an excellent article on this form of mania. It is accompanied with sphygmographic tracings. He says, "Patients deprived of their morphia in asylums are not thereby cured of the craving. They have been forced by a compulsion which has provisionally taken place of their will, and a morphio-maniac is no more cured of this passion by this forced deprivation than is the dipsomaniac by abstinence cured of the passion for drink." He recommends the use of sparteine and nitro-glycerine.

I have found massage and galvanism of great use in simple melancholia. "A melancholy with depression," where the sufferer feels the existence, mental and bodily, overwhelmed and oppressed by gloom, anxiety, and foreboding, due to grief, overwork, or worry. Possibly there may be some hereditary predisposing cause, in fact this is very often the case, but the marked characteristic feature is a depressed, melancholy state. It is common in females at the change of life, and not unfrequently it is associated with some delusion. The despondency may not be extreme, but there seems to be something on the mind from which it cannot be divorced. Such patients invariably suffer from sleeplessness, and a ceaseless activity of mind and body with weakness of purpose, and utter inability to sustained effort; sometimes there may be functional derangement, but this is by no means always the case. They are manageable, but control over them is difficult, their *feelings* are greatly at fault, and their interest in their surroundings and their natural affections are completely perverted, and so is their common sensation. General massage and spinal galvanism, in my experience, has been exceedingly useful.

LECTURE XIII.

MASSAGE IN THE WASTING DISEASES OF CHILDREN, AND IN THE DISEASES OF SEDENTARY, CHANGING AND ADVANCED LIFE.

Importance of studying the diseases of Infancy and Childhood—More attention recently devoted to them by physicians—Opinion and remarks of Dr. Cheadle—Deaths amongst children from preventable causes—Inability of young children to endure fasting—Constant and rapid interchange of tissue necessary to their growth and development—Danger of any arrest in the formative power of the young—Medical treatment adopted for adults frequently useless for children—Reasons for their lack of recuperative and enduring power—Diabetes mellitus—Precociousness in children—The necessity of continuously replenishing formative force—Great care in diet requisite—Wasting in children—Overfeeding very injurious—Susceptibility of children generally to the good effects of massage manipulations—Children in hospital—Drugs seldom used—Causes of Infantile atrophy—Dr. Eustace Smith on massage for children—Children's appreciation of the massage manipulations—Lubricants not necessary—The use of drugs deprecated—Anterior polio-myelitis—Causes of this disease—Efficacy of Massage and Galvanism—Change of life, a period of much suffering—Physical and mental changes developed—Severe symptoms and disturbances—The usefulness of massage—Sedentary life; its dangers—Obesity; its causes, symptoms, and effects—Sedentary habits and occupations; their effect on people of different temperaments; Treatment by massage—Advancing and advanced life—Professor Humphrey's paper on the "Maladies of old people"—Proportion between the sexes in different diseases—Power of recuperation in persons of advanced age—Usefulness of massage in restoring waning power, and in greatly conducing to prolong life.

In my lectures I have dealt rather extensively with those forms of disease which are the result of defective nutrition, and we have seen how, under the influence of massage, digestion and assimilation are promoted. I have to-day to bring before your notice how especially applicable massage is in the wasting diseases of childhood. This is to me a subject of particular interest, and although I have not the time to enter into and discuss everything in relation to this most important topic, still I shall endeavour to lay before you some of the most common landmarks, which I trust may guide you to the true conception and rightful and serious consideration of what is to my mind a question of illimitable magnitude, usefulness, and significance.

Since the establishment of children's hospitals in various parts of London, it may be said that considerable impetus has been given to the study of diseases of infancy and childhood from a purely scientific stand-point, by physicians of the highest eminence, amongst whom may be mentioned the names of Dickenson, Cheadle, Barlow, Gee, Eustace Smith, Robert Lee, Goodhart, and Angel Money. Still there can be little doubt that the general practitioners throughout the country have unrivalled opportunities for accumulating a vast amount of valuable knowledge, if they give their serious attention to the wasting diseases of children. Unfortunately, these gentlemen, who are in busy practice, can scarcely afford to devote the time which is necessary to compiling and comparing facts and putting them into book-form. I very often hear from them of interesting cases which have occurred in their practice, and regret that from some cause or the other they have not been duly reported. Dr. Cheadle says, "Address at the Annual Meeting of the British Medical Association," Glasgow, August, 1888: "Children form the majority of their patients, and the fragile and growing bodies of young infants are singularly susceptible of being influenced by treatment for good or evil. They require a nicety of discrimination, a delicacy of skill in management beyond the common. The first two years of childhood life is the period when the congenital faults of structure and of inherited disease betray themselves. It is the period when all the troubles of feeding and dentition occur with the consequences which they involve. It is the period of congenital syphilis, of rickets, of scurvy, of diarrhœa, of convulsions, of intussusception. The ordinary diseases of childhood are excluded, and even more severe and rarer diseases are usually delayed until the symptoms become urgent, and the time for early diagnosis is past and gone." When we take into consideration the fact that "one third of those who are born die before the completion of their fifth year," the question naturally arises as to what percentage die from preventable causes. Hippocrates says, "Old persons endure fasting most easily; next adults; young persons not nearly as well; and most especially infants, and of them such as are of a particularly active spirit." It must be apparent to all that rapid interchange of tissue is intimately associated with the growth and development of young life.

If the formative power of the young be arrested, it leads to rapid and sometimes uncontrollable degeneration and death. Children fail in recuperative power which is common to more advanced life; the stability of the nervous system is far less sure and defined. Tonic medicines rarely act with young children in the same satisfactory manner that they do with adults. From the period of birth up to the age of puberty the vitality of production is intimately concerned with development rather than with reproduction, hence the rapid exhaustion of childhood can be easily explained and readily comprehended.

All life is intimately associated with a reserve of latent force which responds to demands made upon it for recuperative and emergent occasions, but this is far less in childhood than at any other period. We know quite well that sudden collapse and death in the acute diseases of children are very common: an excitant to the nervous centres in childhood often leads to convulsions and death which would scarcely be experienced in mature years. If we take, by way of example, children whose tissues are, by heredity, contaminated with the effects of syphilis or alcohol, we find that their formative powers are exceedingly inefficient, and if the utmost care is not exercised in reference to the maintenance of heat and oxygenation, retrogressive metamorphosis is sure to ensue, and if this is not apparent as an objective sign, functional troubles arise which are more serious. Take diabetes mellitus for instance. It is known that this unfortunate condition in children is rapid in its progress and leads inevitably to death; in fact, this disease takes as few weeks or months to kill a child as it would years in an adult. Let us for a moment refer to the nervous side of a child's organization, to the mental capacity. Excessive precocity in a child is far from being, as some would suppose, an enviable condition: the balance of activity is invariably one sided; the intellectual draws too largely upon formative pabulum; the grey matter of the brain takes to itself an undue share of nutritive activity; an activity which is inconsistent with progressive and rational correlative development and integrity. Excessive physical, cerebral, and nervous activity can but be complicated with instability and irritability, and the rapidity of discharge being unequal to the nutritive demand, exhaustion, peculiarities of character, fits and convulsions, not unfrequently supervene. But I cannot—although I wish that I had time to do so—carry this interesting subject farther: it is almost interminable. Finally, let me say this: There are many of the finest intellects in youth and young manhood who fail to be the brightest ornaments in the world of literature and science and art, and who not uncommonly meet with a premature grave, simply for the reason that their brain activity is not fondly nursed, cherished, fed, and carefully and judiciously nurtured and cultivated. Thus far I trust I have made this clear to you, that child life is far more readily exhausted than adult life; that formative force must be continuously replenished, not only for existence, but for progressive development; hence we have not one but two nutritive factors in increasing activity. Under normal conditions we are willing to admit that the supply is equal to the demand, but the standard of health must be maintained. If it is not, evil results will sure to follow.

I am not speculative when I say that healthy nutrition in childhood is most wofully neglected. Overfeeding is frequently as disastrous as underfeeding, and it does not reflect wisely or kindly on parents who allow their children to partake of messes instead of good wholesome food, which they know by instinct and common sense must be not only harmful but actually pernicious. "Wasting in children," as stated by an excellent authority, Dr. Eustace Smith, "is a sign of defective nutrition; the waste of the body continues, but new material is introduced in quantity insufficient to supply the loss of tissue." In the processes of nutrition and assimilation the question arises as to due normal functional and metabolic activity. I maintain there is no such thing as excessive nutrition: any attempt at excessive nutrition leads to stimulation of catabolic energy and an arrest of anabolism; in other words, excessive nutrition leads to plethora, inactivity and retrograde metamorphosis. There are lines of nutrition, as well as lines of mal-nutrition; in different words, there are central agencies which govern the one as well as the other. In health these are equally balanced, but a deficiency in the controlling power of either of them is incompatible with normal functional activity and health.

I was first led to the consideration of the value of massage in promoting and maintaining the due performance of the nutritive processes by carefully noting and observing the effects of our manipulations upon the children in our hospital, and I have often been struck with astonishment at the healthy appearance which they presented, the firmness of their flesh and their general well-being. Children, let it be remembered, who, when first admitted, were pale, sickly looking, careworn, and dejected, pent up, so to speak, in the ward of a London hospital, under no other hygienic conditions than those of cleanliness and plain diet, which consists of milk, bread and butter, and meat once a day (usually mutton), but of massage they have plenty. I thought over this matter very carefully and thoroughly, and I came at last to the conclusion that it is possible to advance healthful nutrition in children whose nutritive processes are decidedly defective, and even where their surroundings are in some ways anything but favourable, by massage, and by massage alone, for as far as my little patients are concerned, I rarely have recourse to those stereotyped remedies, cod liver oil and steel. As to the iodides and phosphates of iron, I never think to prescribe them. Malt extract, at one time, I used to administer largely; but since I have learnt the value of massage I might say that the *latter* is by far the best alterative and tonic which I have ever found, and I will back its usefulness in this respect against all the drugs in the pharmacopœia. If proof were wanting concerning the value of massage in aiding nutrition, we surely have it here. The greatest sceptic must be convinced, if he will only take the trouble to see, mark, learn, and inwardly digest the outward and visible signs of the influence of massage. Aperients are rarely, if ever, required, and the most sullen and morose child seems gradually to be imbued under its influence with the attributes of a docile, willing, and kindly disposition.

The wasting diseases of children comprise those which are general and those which are local. Infantile atrophy, uncomplicated with organic disease, is, for the most part, due to an insufficient supply of proper and appropriate nourishment, to mal-assimilation, and to some hereditary taint, which is a constant source of irritation, not only to the lymphatic and glandular, but also to the mucous and nervous systems; acid fermentations, congestions, and parasites are frequently the results of improper and unwholesome feeding. Hereditary syphilis is one of the most important and perhaps one of the most serious causes of atrophy and wasting. The nature of these it is not our province to discuss, neither shall we consider their treatment from any other point of view than that of massage; and if this massage is capable of producing in the child or in the infant what it does in the adult, then we have a very valuable remedy which ought never to be neglected. But its application must be carried on in a continuous, steadfast, and scientific manner; the effects which we know result from its use are precisely those which we believe are absolutely required.

I am not of opinion that the influence of massage is so marked in aiding common digestion as it is in promoting due assimilation and respiration of tissue, still it must be borne in mind that digestion and assimilation are functions which work together; an arrest of one does not invariably lead to an arrest of the other, although this is most frequently and commonly the case. There are some physicians who appear, to my way of thinking, to lay too much stress upon the advantages of massage in children in promoting a healthy action of the skin. Doubtless the rightfulness of this conclusion is one of degree only, but the parts most concerned in the ultimate assimilative processes are the muscles and connective tissue; it is in these that respiration is most active, and in these the ultimate changes of secretion, excretion, and oxidation are elaborated and perfected.

I am glad to find that one so skilled in the study of the wasting diseases of children as Dr. Eustace Smith seems fully alive to the value of massage. In his excellent work on the "Diseases of Children" he writes as follows: "The subject of manual therapeutics has lately received fresh attention, and the impetus which can be given to healthy tissue change by a skilful kneading and working of the muscles and subcutaneous structures, has been taken advantage of in the treatment of various forms of chronic disease. Amongst others, in long-standing cases of chorea great benefit may be derived from energetic massage of muscles and manipulation of joints, so as to excite active muscular waste, while at the same time the increased tissue wants are satisfied by a copious dietary. In rickety children, whose backs are limp and powerless, very evident increase of strength quickly follows regular and vigorous shampooing, and in obstinate costiveness important results can be obtained by systematic kneading of the abdomen combined with suitable frictions." Interested as I am in the value of massage, I am more than pleased to find that my ideas are borne out by one whose experience and knowledge are worthy of most serious consideration.

Dr. Smith does not state in what systematic kneading of the abdomen consists, but I hope from what I have told you you will be quite equal to the occasion whenever your services are required. In masséeing children, the general principles of this mode of treatment apply with equal force, as they likewise do in masséeing adults; but in the management of children, special attributes are called for: kindness, sympathy, and love for children are required, as well as manual dexterity. You will be surprised to find how very fond children become of massage manipulations if they are treated in the right way; they appreciate acutely and even sensibly the manner in which these movements are being performed. I cannot say that they are conscious of its tonic and invigorating powers, but they never, in my experience, fail to realize the soothing, calming, and composing influence which it undoubtedly exerts. Every nurse should understand massage, and every child's limbs should be manipulated for a quarter of an hour night and morning, with unswerving punctuality. If this were done we should become a finer, a hardier, a more enduring, and a more intellectual race than we are at present, and we should hear much less of nervous disease in the after-stages of our existence.

I would draw your attention to the anointing of children with oils: this system doubtless has many advantages, but let me impress upon you a hard and fast rule, from which I never sanction any deviation: Apply your massage first; your own skin should come into direct contact with that of your patient; then you may work in cod oil or any other oil you like. In my experience it matters not one iota what kind you use, but it must be some natural animal grease. Experience proves, no matter what the physiology may be, that oil rubbed into the skin of young children of a weakly and delicate constitution, allays irritability and promotes nutrition; some say that it gets absorbed and in this way supplies nourishment, of this I have my doubts. I believe that its action is rather indirect than direct. It certainly allays undue excitability, and this secures normality of function, such as an increased perspiration and secretion of urine; and, according to Bauer, of Tubingen, the liver is rendered more active, and the stools from being green and sour smelling become yellow and natural. Depend upon it, much harm is done in child life by an indiscriminate use of drugs. The artlessness of a child's nature is consonant with simplicity of its physical being: disarrangement in function is often the result of the slightest causes, and the re-arrangement is almost invariably best brought about by the most simple and artless modes of treatment. The best intrinsic, and, at the same time, objective, evidences of normal development of tissue in infancy and in childhood relate to the osseous and dental structures, the closure of the anterior fontanelle and the eruption of the temporary teeth. The former should be compact about fifteen months after birth, and the central incision teeth should make their appearance about the seventh month. Of course there are many other points to be taken into consideration, to which I cannot possibly refer, and I merely, in passing, mention these as initial signs for guidance which should never be neglected, for failures in these developmental processes are invariably attended with general mal-nutrition and wasting, which is sometimes progressive and fatal in an almost unaccountable manner.

The wasting diseases of children appear to be associated with (*a*) inherited syphilis, (*b*) rickets, (*c*) scurvy, (*d*) scrofula. These can scarcely be referred to as the cause of atrophy or wasting; on the contrary, they are connected with a diathetic condition, which has for its foundation, whatever the deficiency of the superstructure may be, an incompleteness in the formative force which is so essentially correlated with the requirements necessary to the growth and differentiation of tissue in childhood and youth. I feel sure that good regular feeding, massage, perfect hygiene, warmth, sunlight, and fresh air, will best stimulate the formative powers to increased activity, and secure that vitality without which all artificial modes of treatment are valueless and unprofitable.

I must now, before leaving this subject, call your attention again to a state of local wasting, which is remarkable in many ways, and is, in my experience, becoming more common than formerly; and its seriousness should compel us to know more about it in order that its disastrous and ill effects might, at a much earlier period, be met and counteracted. I refer to what is known as "infantile paralysis," or "anterior polio-myelitis," "atrophic spinal paralysis," in which we find that muscular wasting is a prominent symptom, the paralysis depending upon destruction of the nerve cells, particularly in the anterior horns of the spinal cord from which the axis cylinders of the motor nerves originate. It may be said that this affection is particularly one of childhood and infantile life, but it is by no means confined exclusively to these periods. It may come on soon after birth, but it is most commonly found in children of from one to five years of age. Its etiology in many cases is questionable, although a frequent cause is exposure to cold and chilling of the body when the skin is in a state of perspirable activity.

I have two children of one family now under my care, where the cause of this disease seems to have been excessive fright during a thunder-storm. They went to bed apparently in perfect health, and the following morning they were unable to walk. The onset is sometimes attended with symptoms akin to those which usher in a severe illness; shivering, and fever; sometimes delirium supervenes, with an excessive rise of temperature. The injury may be confined to one limb, or all the extremities may be affected, although rarely in like degree. The paralysis is motor only, without loss of sensation. Gowers says, "The growth of the bones is retarded," but this certainly is not distinctive. I have paid some attention to this subject, and in growing children have frequently observed the bones maintain their length of growth as compared with the bones of the healthy limbs, although the general substance of the bone is invariably wasted. This is a point of great interest. I cannot enter into the many details of this peculiar affection, suffice it for my purpose to say that the muscles undergo rapid degeneration and present the degenerative reaction in its most characteristic form, namely, loss of faradaic irritability with maintenance of voltaic irritability. The latter may be increased for some time, but as the muscular fibres degenerate the response to the continuous current is gradually lost. The prognosis cannot be considered hopeless, as I could prove to you if I had time by the records of a considerable number of cases; but in my opinion, and in this matter I can speak from experience, local treatment should be adopted early. By treatment I mean massage and a weak galvanic current. Many of these cases unfortunately present themselves to our notice when any form of treatment is irremediable and hopeless.

Change of Life.—It is usually between the ages of forty-five and fifty-five that a woman is said to be passing through a transition state of existence known as the *change of life*, and there can be no doubt that this period forms an important event in every woman's history. Every life reaching threescore and ten years must undergo a cycle of changes; these waves of alteration are, for the most part, gradual and almost imperceptible, nevertheless time with its relentless and unsparing hand marks its victim with unerring constancy. The elixir of life has not been found to protract the verdure and the elasticity of youth. Some women suffer severely at this period of change, and when the great function of menstruation ceases, when the ovaries have fulfilled their allotted task, and the uterus fails to be the centre of an active discharge of blood from the system, truly a momentous and revolutionary epoch marks its advent, and exercises an influence upon the circulation and nervous system, which—although some few seem to enjoy comparative immunity—produces in the majority such a condition of disturbance and discord throughout their entire being that right glad are they when the temporary derangement is over and everything has again settled down to a state of definition, regularity, and harmony. Nature has arranged that a change so vital and physically omnipotent should be attended with as little distraction as possible, therefore the process is usually gradual. Its progress is sometimes considered to be too long in its action, nevertheless the future results are invariably of a similar nature, and some women who have been ailing for years prior to the climacteric event, will, after its departure, enjoy a good state of health which has been hitherto unknown by them. We must, if you please, take into our consideration very briefly some of those ailments which are commonly associated with change of life, and I think that I shall be able to prove to you that massage is one of the most valuable remedial agents in bringing about a happy termination to a condition which is often feared and dreaded.

These changes are for the most part temporary and functional in their nature, and the circulatory and nervous systems feel the confusion most. For the sake of conciseness we will divide these into two classes, physical and mental. I may say with truth that during this decade all perversities of nature, whether they be physical or metaphysical, inherent or acquired, make themselves apparent in a manner, and sometimes with an unconsciousness of them on the part of the individuals, which is perplexing and astonishing to those with whom they are daily and hourly associated, and on this account many derangements of body are neglected and supposed to be due to natural causes when they really call for medical skill and interference. The physical effects, then, of change of life are primarily due to an altered condition of the blood and its circulation throughout the body; spasms of vessels are attended with a deficiency of blood in parts most distant from the heart, *dying away*, as it is called, of the hands and of the feet are peculiarly frequent and are constantly being brought under the notice of the medical man. The woman wakes in the morning with what is best known to her as a sleepy state of the limbs; the hands and feet are icy cold, and blanched, devoid of sensibility, causing for the time muscular inco-ordination and a want of muscular sense, a "dying away condition." Sometimes there is considerable pain and a feeling of numbness, tingling, creeping, itching, and burning, putting the hands into cold water creating a scalding and very painful effect; but after a few hours of bodily activity the circulation is restored and the normal state is regained. This spasm of vessels may extend so as to lead to impairment of the special senses; vision is sometimes attended with obscurity and absence of definition, varying in character from day to day; or it may be the cause of giddiness; there may also be nervous deafness, as one frequently hears it called, accompanied with all sorts of ill-defined and strange noises in the head; even taste and smell are occasionally perverted, deranged and misleading; and the alteration in the voice and respiration leads to the idea that something is really wrong with the larynx and the lungs.

Hæmorrhages of a vicarious kind sometimes occur, and not unnaturally occasion considerable alarm. The eyes and tissues around may be the seats of hæmorrhage, giving an appearance similar to that produced by a violent blow, or large quantities of blood may be ejected from the stomach and voided by the anus or the bladder. There may be an arrest of function on the part of any organ, the liver, the kidneys, and the stomach. The metabolic processes of nutrition and repair may be rendered inactive, and rapid waste of tissue may result; or, on the other hand, a woman may suddenly become inordinately fat. The quantity of urine secreted may be excessive or limited to a minimum. Cravings of a kind may arise hitherto unheard of, and a sense of *emptiness* (which sounds vague to the inexperienced) may be felt at the head, stomach, heart, or bowels. Of all physical disturbances I think those relating to the fifth nerve are the most common.

Headaches of the hemicranial or megrim type often cease altogether, and give place to a feeling of fulness and tightness or sense of weight and pressure over the vertex, or dull indescribable feeling at the back of the head, and behind the ears. Sometimes patients have told me that their heads felt like so much putty. A not uncommon, though a most distressing symptom, is that within the skull as of worms or insects crawling over the brain. Sometimes, but rarely, headaches will assume a most distracting and intense type, so that patients will scarcely know what to do with themselves. Formications of the skin of the face are often very troublesome. Neuralgias of the head and face which have been slumbering and inactive, only making themselves occasionally evident, will light up with great energy and become inveterate. And, again, it must not be forgotten that, owing to the arrest of nutrition, the normal formative efforts are liable at this time to become perverted, reversing the natural order of things to that of abnormality, resulting in cancerous and other erratic developments; and numerous functional derangements which are common to any and every period of life are still more prone to make themselves evident at this.

These are a few only of the physical functional effects common to the *change of life*. Now let us see what functional mental disturbances are prone to arise at this period. The self-same cause which we have briefly noticed in reference to the production of physical effects gives rise also to mental derangements, this cause being impure blood and its insufficient, irregular, or excessive supply, and defective nutrition. The mental results are, subsidence and inebriety of faculty; in other words, an abnormality of reasoning power, as well as intellectual alienation, amounting to an abrogation of concrete conceptuality. The mind, as an organ of reason, is diverted from its normal channels of ideational integrity, and lends itself to a speculative and imaginary train of thought, mystical, fanciful, and falsely representative—completing a substantive representation of impaired functional capacity. At one time melancholy is a prominent feature; at another, dementia; at another, aural and visual hallucinations, and at another, sheer nervousness and perversity. It would be out of place here if I gave you clinical evidences of associated signs and symptoms relative to, and connected with, these conditions, but you must clearly understand that they have a physical basis, that certain areas of brain matter are involved, and that vascular spasm is often at the bottom of these mental troubles. Mental functions, like physical functions, are balanced by a system or systems of antagonism, and by the natural process of evolution in man we are rightfully led to the conclusion that the mental stands upon the highest level, the perfect integrity of the two is alone maintained by an absolute balance of power. A few practical remarks will enable you to follow my simple reasoning upon these points.

When the nervous system is affected at "the change of life," we find that women are, not unfrequently, weak and feeble in mind and character; if the lower centres are involved, the result is muscular asthenia, and the whole condition is that of pseudo-imbecility, irresolution, irritability, and exhaustion.

An undue excitability is as sure a sign of mental weakness as is the undue excitability of a nerve or muscle; and we find our patients simply as effusive in their loquaciousness without any fixed point or continuity of reasoning, as would be the inco-ordination of a muscle from exhaustion of its nervous supply. From the mental side of the "change of life" we are thus led to conclude that the conditions are functional; that they are due to some defect of the circulation, consequent upon nature's process of re-adjustment and compensation; that they are usually of a temporary character, but that medication is frequently required. The derangements of the nervous system, motor, sensory and sensorial, are secondary to the circulatory disarrangements, never forgetting the influences associated with predisposition. Admitting, if you please, that anæmia, mal-nutrition and exhaustion are the immediate factors. In all cases, resisting power is deficient both from the *ego* and vital points of view. Of course, the question now is—Can we do these patients any good by massage and galvanism? Can we aid nature in her efforts to restore the normal balance of the circulation and promote nutrition? Well, I can tell you from my own experience that we can do an immense deal. I do not like to speak with too great certainty, but I firmly believe that many of these cases which have passed through my hands would have drifted into a hopeless state of dementia had it not been for the massage and electric treatment to which they were subjected.

We have now to consider two other conditions where I think you will find massage to be of unfailing and meritorious service: these are in sedentary and advanced life. My lamented friend, Dr. Milner Fothergill, wrote an excellent work entitled "Diseases of Sedentary and Advanced Life," of which he was justly proud, and I am more than glad to quote a few sentences from the writings of so illustrious a man, unfortunately taken from us in the prime of life, a life devoted to his work, fearless of opinion, careless of renown, honest in purpose and intentions, serious and earnest, but withal, practical in following out what he believed to be the true and righteous concepts of science—science as nature claims her, simple and truthful, unadorned with canonical wreaths of man's aimless sanctity—such was John Milner Fothergill. *Requiescat in pace.*

Sedentary life is not a healthful life, but I am disinclined to an impartial agreement with Dr. Fothergill that it is productive of every form of derangement of function and tissue change. On the contrary, a sedentary life, with definite rules of hygiene and diet, indicates a conservation of power and energy which, if misapplied in the production of excessive activity, is likely to lead to undue friction and wear and tear tending to premature exhaustion and its consequences. It would be unwise if we did not take this into consideration. A sedentary life with mental liveliness and animation is a very different thing to the sedentary life of the slothful and the indolent, yet withal a sedentary life has a train of evil consequences, even under the best conditions, conditions which cannot fall to the lot of those whose organs are occupied in the due fulfilment of functions with which they were endowed by nature towards the achievement of certain ends. My object in bringing this subject before you is merely to remind you that there are bodily changes, the result of inactivity, which, if not of a strictly degenerative kind, are attended with discomfort and inconvenience. Let me take obesity by way of example. Many persons are actually too stout for either health or comfort. Dr. Fothergill refers to this in a somewhat quaint but purposive style of diction. "All must have seen an undue obesity in corpulent ladies who live well and lie warm, who take carriage exercise only, and are scant of breath if they climb three stairs. In all these cases there may be a superabundance of fat in and upon the heart, but that is of less significance than the general condition. The blood is always charged with nitrogenized waste, whether the urine be clear or laden with lithates. Such persons are fed to repletion, and, like the lazy, over-fed monk of old, they ought to have less sleep and more exercise. They remind one of the fat Italian priest, the victim of gout, who was taken prisoner by the Turks, and converted into a galley-slave. This position might not be an enviable one by any means, but he regained his health and lost his gout as the outcome of his new regimen." I think we may fairly look upon obesity as one of the inflictions of a too sedentary life. If the individual cannot or will not change this mode of existence, surely there is no better means of compensation than that of massage, and although I thoroughly believe in a well regulated dietary, with an absence of saccharine elements, still I am sure it is a mistake to carry on Bantingism to an unlimited extent. In my own practice, during the past twelve months, I have had some really excellent cures of obesity by massage in persons who did and would lead sedentary lives whatever might be the consequence. My experience certainly guides me to the conclusion that an unhealthy amount of fat causes a very characteristic state of lethargy, indisposition, and laziness. Unhealthy fat is associated with exhaustion and its train of symptomatic troubles, equally as much as a deficiency of fat. There can be little doubt that some people in this mixed world of various and varying types can bear a life of restraint or a sedentary life with much greater equanimity and with less danger to health than others can: the thin, wiry, caustic individual whose stomach can digest nails, and whose waste is exactly equivalent to his repair, apparently loses nothing and gains nothing; the interchanges, circulatory, nervous, and mental, go on from day to day with wonderful rhythm and regularity, his habits are punctuality itself, and his diet usually of the plainest and most moderate kind. But this is not the case with a man of more plethoric habit of body and with naturally a good deal of gout in his blood. A sedentary life would not suit this individual unless he lived upon nothing but whey and biscuits. But this type of man is fond of good living, and with little or no exercise his blood very naturally gets loaded with uric acid and he becomes lithæmic. It is quite possible that there may be no outward manifestation of gout, still as is too frequently the case, it may be retrocedent, suppressed, and latent, and this means a damping of the fires and a choking of the flues, leading to inactivity of the liver, indigestion, and a host of troubles, which may be only slight, or may be severe and associated with the gravest forms of arterial change. Well, all I can say to such as these is, "If you will not or cannot take exercise, have your body masséed regularly every morning for one hour from seven to eight o'clock, and you will soon throw away your blue pills and your black draughts, and your peptonizing powders."

Advancing and Advanced Life.—Lastly, let us consider whether massage can be of any value at all in advancing and advanced life. Does it retard the dying out of tissue? Does it aid the structures to retain a fair amount of elasticity? Does it keep the joints supple and the muscles from getting stiff? Does it keep the skin in a healthy condition and prevent premature wrinkling and shrivelling? I certainly believe that it does all this, and more even than this, I am sure that it prolongs life.

Professor Humphrey, of Cambridge, in a paper on "The Maladies of Old People," which is to be found in the *Medical Journal* of July 30th, 1867, presents an analysis of 824 persons. Of these there were 340 males and 282 females between 80 and 90, and 92 males and 110 females between 90 and 100. With regard to diseases and failures of particular organs, the immunities were in favour of the women, amounting to 55 per cent. as compared with 35 per cent. in the case of the men. The affections of the urinary organs especially preponderate (as we might expect) in the men.

They are indeed twice as frequent in the men as in the women, amounting to 42 per cent., whereas in the women they are only 20 per cent. In the women brain affections are more frequent than in the men, being 16 per cent. to 7 per cent. But the failures of the heart and of the lungs are about equal in the two sexes. It is worthy of note that 85 per cent. of the whole number are reported to be free from any evidence of rheumatic affection of the hands. Of all diseases brain affections and the *recoveries* from them in old people are amongst the most remarkable of their maladies. Fifty-two people were troubled with rheumatism in its various forms, "for which," says Professor Humphrey, "I suppose a remedy is not very easily to be found." In this respect I beg to differ from Mr. Humphrey, for massage, as far as my experience has gone in the treatment of the rheumatic pains and stiffness of limbs in old people, is most valuable, in fact, its usefulness in this respect is second only to its power in the wasting diseases of children. But now we come to the most interesting point in the whole of Mr. Humphrey's very valuable paper, and it refers to the remarkable healing power of the aged, not only after local lesions, such as fractures, wounds, and ulcers, but to the reparative powers evinced by them after illnesses. He remarks —"Those inferences are so contrary to pre-conceived notions, indeed to probabilities, that it takes some time and effort and frequent repetition to obtain for them a fair measure of acceptance, but I think the reparative powers of age are becoming more accredited, and that we shall ere long cease to have age adduced as a reason against the hopeful and careful treatment of fractures, wounds and sores in the octogenarian, the nonagenarian, and even in the centenarian." This is all very well and very true, and it goes to confirm my previously expressed opinion, that regular massage in advancing age tends to prolong life; but there is a stage in advancing life between fifty-five and sixty-five, when in some people age creeps on apace; they feel they are getting old, their muscles become weary and even tender towards their fibrous attachments after a small amount of exercise; after sitting down their lower limbs become *uncommonly* stiff, and the least over-strain of the muscles of the back gives them sharp pains about the lumbar regions; the joints, particularly the knees and the hips, are painful upon movement, feel dry and are given to crack; the skin is wrinkled and the hair is white and *very void;* they have a sudden tendency to stoop, and the muscles are destitute of firmness. Now, in some of these cases I have been truly astonished to see the wonderful influence which massage has had in restoring a healthy tone and giving to these people an appearance of comparative youth really remarkable. A gentleman over seventy consulted me for what he called stiffness, particularly about the lower limbs. After sitting down for a little time he became so stiff that he had difficulty in assuming the erect posture again. A course of massage cured the stiffness entirely, and he declared that it had made a new man of him.

We have now considered massage manipulations in almost every way in which I should judge them likely to be of great service. I shall in the next two lectures confine myself to electricity and its practical application to the human body.

TWO LECTURES
ON
MEDICAL ELECTRICITY.

Lecture XIV.—ELECTRO-PHYSICS.

Lecture XV.—ELECTRO-THERAPEUTICS.

These two Lectures on Medical Electricity are a necessary addition to the foregoing Lectures on Massage. We find that massage and electricity have a combined value; so much is this the case that the best results of massage are frequently dependent upon electricity as an auxiliary. Of the two modes of treating disease, I certainly have met with more decided therapeutic results from the former than I have from the latter, but the medical use of electricity is still capable of more extended application and experience. I am quite sure that we must view both these agents as aids to treatment only. It is simply irrational and quackish to give to either massage or galvanism an empirical value which it does not and never can possess.

LECTURE XIV.

ELECTRO-PHYSICS.

Massage an aid to Electricity—Electricity as an agent for transmitting power compared with air and water—Galvanism and Faradism—Electrical action and Chemical action—Generation of Electricity—Electro-motive force —Leclanche's cell—Amalgamation of zinc—Advantages of zinc and carbon elements—Difference of potential—Potential at different points of a conductor —Internal resistance—Polarization—Circulation of the current—Polarity of elements in the galvanic cell—Terms of poles, &c.—Conduction—Resistance—Examples of resistance—Volt, Ohm, Ampère—Velocity of current—Rheostat—Resistance of the human body—Collector—Voltaic alternatives—Voltameter, description of—De Watteville—Galvanometer—Magnetic deflections—Nature of Ohm's law—Polarization—Apostoli Faradism—Galvano-faradic, Magneto-Electric currents—Induced currents, strength of—Induced current, explanation of, nature of—Gaiffe's apparatus—Faradic battery—Galvanic battery—Electricity induces Magnetism—Temporary and permanent Magnetization by Electricity—Figure for illustrating Galvano-faradic induced current—Action of the induced coil—Galvanic cautery—Cautery battery—Static electricity—Electrization—Dr. Morton on the use of Static Electricity.

THIS lecture treats of some of the most simple fundamental principles and attributes of certain phenomena or modes of molecular motion embodied in the term *electricity*. I shall deal with the subject in its concrete, rather than in its abstract and differential forms, my object being to explain and make clear to you that under given conditions we can generate a something to which the name electricity is given, and which is capable of transmitting power. My duty, then, is clear and defined. Let me see if I can make my ideas clear to you also. We can, if you like, consider electricity in the light of an imaginary fluid and compare it with water. You know that water pressure is capable of transmitting power, as illustrated by the vast system of high pressure mains which have been laid throughout London. Compressed air also is capable of transmitting power, the ordinary pneumatic bell being an example.

You will observe that I class together air, water, and electricity; by that I do not mean to imply that electricity is a fluid, although in many respects it acts like a fluid, like a fluid of very little mass however, or, odd as it may seem, like a fluid moving extremely slowly, for electricity goes round sharp corners with perfect ease and without any of the phenomena of momentum possessed by rushing water. But what I particularly wish to impress on you by classing air, water, and electricity together is that electricity is not, as some people seem to think, a something that can be burnt or in some way used up and so work got out of it. Electricity is no more a source of power than a bell wire is; electricity is a marvellously convenient agent for conveying a push or a pull to a great distance, but it is not by the using up of the electricity that electric lights burn or that electro-motors revolve. It is by the electricity losing pressure exactly as water loses head when turning the miller's wheel as it flows down hill, that work is done electrically.

At the end of this lecture I shall have to say a word or two to you concerning *frictional electricity* or *static electricity* (Franklinism); but in consequence of the difficulties met with in developing it, on account of the humid condition of the air in this country, it has not been adopted in the treatment of disease so much as it otherwise would be, but it has its uses nevertheless. So I shall confine my observations especially to those *two* forms of *current electricity* known as (1,) *galvanism, voltaism, contact electricity* and the *chemical or constant current;* (2), *faradism*, the *magneto-electric*, the *interrupted*, or the *induced current.*

You must look upon current electricity as you would a current of air or a current of water, moving at a given rate in a certain time at a given velocity, exercising power and performing work in direct ratio with the resistance it has to overcome.

Current electricity or continuous flow of electricity is the result of *chemical action*, or perhaps it might be more correct to say that chemical action is accompanied by and probably produces *electrical action*, and this I shall make evident to you by the galvanometer and other means.

In order to generate electricity we take a couple of *dissimilar elementary* substances (*electro-motive*). We may select them from the following: Carbon, platinum, gold, silver, copper, iron, tin, lead, zinc. For medical purposes carbon and zinc are usually preferred. It is my intention to confine my observations to these two elementary bodies. If they are brought into contact in the presence of some *exciting fluid*, say dilute sulphuric acid (1 to 9) or solution of chromic acid (4 to 20) or a saturated solution of sal ammoniac, in one of them *positive* electricity, and in the other *negative* electricity can be detected.

Directly the zinc and the carbon touch, either *inside* or *outside* of the liquid, *chemical action* takes place. Bubbles of gas appear on the *carbon* and rise to the surface of the liquid, which may be shown to be *hydrogen*, whilst the zinc (if sulphuric acid be used) is gradually corroded and consumed, the white solid sulphate of zinc being formed in the vessel. The chemical action is thus expressed:—

$$Zn + H_2SO_4 = ZnSO_4 + H_2.$$

You will observe that the carbon undergoes no chemical change, but the chemical action upon the zinc by the sulphuric acid has given rise to a force which is known as *electro-motive force*.

Electro-motive force must be looked upon as an imaginary force; it is a property of matter giving it a capacity for work just as energy in the world of mechanics is its capacity for doing work. In man's bodily organization there is the capacity for work, and in the collection of parts that make up the steam engine, holding certain relative positions and to bodies outside them, there is the capacity of doing work. The possession of a body of energy gives to it the power to do work, just as the possession of electricity of electro-motor force gives to it the power to do work, therefore a galvanic battery generating the electric current depends for its strength upon its electro-motive force, and the tension and strength of the current is due to this electro-motive force, which is the outcome of difference of *potential*, and this is why it is usual to say that *electro-motive*

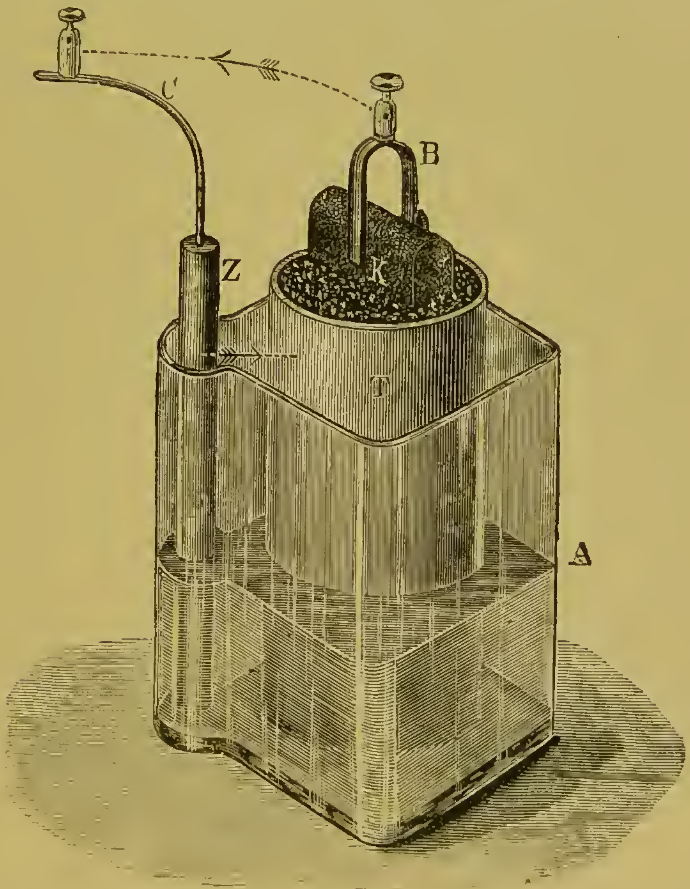


Fig. 37.—Leclanché's cell.—A, outer vessel; T, porous cylinder containing K, carbon; B, binding screw of positive pole + (anode); Z, zinc; C, binding screw of negative pole (kathode). The arrows denote the course of the current from the zinc to the carbon inside the cell and from the carbon to the zinc outside the cell.

force and *difference of potential* are synonymous; and we shall directly see how this force is measured, and other points in reference to it.

I now show you a Leclanché cell (*Fig.* 37).

You see it consists of an outer vessel made of glass, in which we note the *first* element, a rod of amalgamated zinc. Let me say a word here with regard to the *amalgamation* of the zinc. It is very important that you should know how to do this for yourselves, and understand the reason why amalgamation is necessary. For uniformity of working, and for obtaining the maximum effect, it is essential that all parts of the zinc should be acted on equally by the solution. Ordinary commercial zinc, besides other impurities in the process of cooling, becomes unequally annealed, different parts of it are unequally hard, and are attacked with different facilities by the same acid. Pure zinc carefully annealed is not attacked at ordinary temperatures by pure sulphuric acid. Two pieces of zinc, one of which is more easily attacked than the other, will, when in contact with an acid and with one another, form a couple, the more easily attacked being + and the less easily –, just like a piece of zinc and copper respectively. Such an heterogeneous piece of zinc when used as an element in a cell fritters away some of its general electro-motive power by establishing local currents. It seems that the chief cause of this inequality of action is due to difference of hardness rather than metallic impurities, for if the surface of the zinc be moistened with sulphuric or hydrochloric acid and mercury smeared over its surface until the zinc is uniformly amalgamated, such local currents are completely arrested. The metallic impurities cannot certainly be removed in the process of amalgamation. But inequality in hardness, due to irregular cooling, can easily be removed; for as the mercury penetrates, the mass softens and molecular strains are relieved, and uniformity results. This is so complete that amalgamated plates may be left in contact with dilute sulphuric acid for any length of time without dissolving.

The *second* element is the plate of carbon, and the liquid a solution of chloride of ammonium. The zinc is in free contact with the chloride of ammonium. The carbon is in a porous cell; the space between the carbon pole and the wall of the porous cell is filled tightly with a mixture of carbon and peroxide of manganese in coarse powder. Chloride of zinc is formed, the separated ammonium immediately decomposes into hydrogen and ammonia, the latter of which at first dissolves in the solution and, when this is saturated, escapes as a gas. The hydrogen, meanwhile, after causing in the usual way successive decompositions of the contiguous molecules of chloride of ammonium, appears through the porous cell, and finds itself at last in contact with the peroxide of manganese, this oxidises the hydrogen to water, being itself in the first instance reduced to the form of sesquioxide, according to the equation

$$Zn + 2ClNH_4 + MnO_2 = ZnCl_2 + 2NH_3 + H_2O + Mn_2O_3.$$

The advantages of this combination is that the zinc is not consumed when the cell is not in circuit. The object of the peroxide of manganese is, as I have just stated, to give up its oxygen to the nascent hydrogen to form water, and were it not for this combination the hydrogen would collect in such quantities over the surface of the carbon as to *depolarise* it, bringing about an *internal resistance* which would be highly adverse to the *working* of the cell.

The electro-motive force of a Leclanché cell is about 1·5 volt, or more correctly 1·48 volt, and its internal resistance about 3·5 ohms.

I have here another and more recent form of Leclanché cell. You see there is no porous cylinder in it, this simplifies the thing very much and renders it easier to recharge and clean. Now, I am anxious, as I cannot possibly describe to you each of the different forms of cells which are in use (excepting in a very off hand way, when speaking to you of current tension), that you should keep this cell with its elements (electrodes) in your mind, and remember, if you please, that it possesses so many advantages that we may look upon it as the *medical cell.* It is well suited for intermittent work, and it has the special superiority that it is cheap and requires little attention. We shall have to study this cell carefully, and if we know something about it we shall have an idea of the foundation of the science of galvanism. In the first place we have what is necessary for the generation of the galvanic current, the two *dissimilar elements,* carbon and zinc, separated by india-rubber bands, and surrounding them we have our fluid which we may call the *exciting agent,* which acts *chemically* on one of them. Volta considered that the *contact* of two different metals was alone necessary to the production of electricity, but our distinguished physicist Faraday came to a different conclusion, namely, that in order to create force there must be an expenditure of energy, and that something more was required than the mere contact of the metals, in fact that *chemical agency* was necessary to keep up the *difference of potential* between the two metals.

DIFFERENCE OF POTENTIAL means a difference of *level* between two points in order to bring about a flow of the electric current, or, for example, a current of water. The point from which electricity (or water) flows must be at a higher potential (or level) than the point to which it flows: we have, then, with regard to the electric current, a *positive* as well as a *negative* flow, which always takes place from the *higher* to the *lower* potential, so that by the *positive* or *negative* potential of a body is meant that the electricity with which it is charged must be of a kind *positive* or *negative*.

DIFFERENCE AT DIFFERENT POINTS OF A CONDUCTOR.—*Difference of Level* bears the same relation to pressure in a hydrostatic system as *difference of potential* bears to electromotive force in an *electric one*. Again, *electric potential* is directly comparable with *tension;* for *tension* is proportional to the *pressure* which is producing it. Accordingly, if the two extremities of a conducting wire have the same *potential*, the electro-motive forces along that wire will be equal and opposite. In other words, there is no resultant electromotive force between the points, and no current passes. In all cases, just as in mechanical problems, two equal and opposite forces may be withdrawn or added without altering the conditions; so we may suppose that any wire, through which no current is passing, is simultaneously traversed by *equal* and *opposite currents*. In doing so, we should, however, be obliged to lose sight for a moment of the generally received "explanation" of *current motion*, namely, *difference* of potential, which is after all only a mode of expression.

Now let us apply this difference of potential between the elements in the battery itself, the *internal* electrodes, the zinc and the carbon, and this will lead on to the consideration of *polarity*.

My Leclanché cell is now in action, for I have connected the two elements by means of this piece of copper wire, and the electric current is passing *in circuit*, or I should rather say the two currents are passing in circuit, namely, the *positive* and the *negative*, and my Leclanché cell is in its greatest state of activity. It is what is usually known as short circuited; by this is understood that the currents have no *external resistance* to overcome, excepting that which they find in the copper wire; the only *resistance*, then, to the two currents meeting and neutralizing one another's activity exists in the fluid between the two elements, and this is called the *internal resistance*. It is important, therefore, that the exciting liquid in the cell should not only be such as will act chemically upon one of the plates, but it must also be a compound of which the particles or molecules are capable of *polarization;* with bromine or with a solution of chlorine no current of electricity is obtained, though these substances act powerfully on zinc. With the compounds generally employed—either acids or salts—the chemical force passes through the liquid from one plate to the other, and doubtless the electrical force also passes through the liquid from one plate to the other. Let us see. The two elements in the Leclanché cells are kept at different potentials by chemical agency, and the highest level of these potentials is to be found with that element upon which chemical activity is exercised. *By the difference of potentials the generation of the electric current is maintained.* When there is no difference between the potentials, when they are both at the same level, the battery is said to have *run down*. *Now the chemically-active plate* is that from which the *positive* current flows to the *chemically-passive plate* through the liquid. The chemically-active plate in this cell is the *zinc*, and the chemically-passive plate is the *carbon*, so the chemically-active plate, the zinc, is *positive* to the chemically-*passive* plate, the carbon which is *negative*. By the law of potentiality the positive current is found and withdrawn from the negative plate and the negative current is found and withdrawn from the positive plate. Hence it is invariably seen, and this is a rule to which there is no exception, that when a current passes from A to B it is the metal A which is mainly attacked—generally it alone is attacked. The very fact that the hydrogen is evolved on the carbon insures the latter remaining unattacked. We are now in a position to consider the

CIRCULATION OF THE CURRENT, means the continuous circulation of the electrical force, and has given rise to the terms *electrical current* and *current electricity*. When the circuit is completed (1) the plates become polarized, (2) the molecules or particles of the liquid between them also become polarized, (3) chemical action (decomposition and recomposition) takes place across the liquid, (4) positive electricity takes its origin, as we have seen in the chemically-active plate, (5) across the liquid to the negative plate, and (6) proceeds by the wire outside the liquid to the positive plate. The negative current may be traced the reverse way—from the carbon through the liquid to the zinc and through the wire outside to the carbon.

You can, I hope, now understand how it is that *positive* electricity leaves the cell by the wire fastened to the carbon element, whilst *negative* electricity leaves the cell by the wire fastened to the zinc element: the place of junction therefore by the wire and carbon element is called the *positive* pole and is at the top of the *negative* plate, the *negative* pole is at the top of the *positive* element, the zinc.

We can now make ourselves acquainted with certain terms which have received general acceptance, and which are applied to the terminals of the *positive* and *negative* poles, the term *Anode* is given to the conductor which is attached to the *Positive* pole, and the term *Kathode* is given to the conductor attached to the *Negative* pole. In speaking of currents, instead of using the words *Positive* and *Negative*, it is serviceable sometimes to apply the words *Anodic* and *Kathodic*. The word *Electrode* is common to any material which is applied to the end of the conducting wire by which the current is made to enter any part of the human body (the part by which the current enters and leaves the body, electrolyte.) In electrolysis, which we shall have to consider in our next lecture, the products which appear at the *Anode* are called *Anions*, those which appear at the *Kathode* are called *Kations*. The *Kathodic* or *Negative* is the destructive current when applied to tissue, but this I shall demonstrate to you directly. It may not be quite scientific to speak of a destructive current, but by this I mean that the electro-motive force has an initial capacity or energy or intensity which enables the current to overcome resistance which the positive current does not possess.

So much for this galvanic cell and its electro-motive force with which we must now become better acquainted. I attach the ends of these two pieces of insulated copper wire—(you see they are covered with gutta-percha which is a non-conductor of electricity)—one to the positive, and the other to the negative pole, and when I bring the ends of these wires into contact I create a difference of *potential* in the cell, and the electric current is immediately transmitted along the wires. If I place their terminals to my tongue I experience a sharp tingling sensation, and a distinct metallic taste, it is thus seen that the wires are *conductors* of the electric current. These wires are termed *rheophores*. This which I now show you is termed a double rheophore, it thus divides the current and diminishes its intensity, and by this means I can make it act upon two points at the same time, or by further subdivision I can make it act upon any number of points. Let me make it more evident to you that I have a current of electricity passing along the wires. I now place this galvanometer in circuit, and you see the needle is slightly deflected, and in direct ratio to this deflection I am able to ascertain the strength of the current which is passing. We shall have more to say about this, but I must first make some reference to two conditions concerning the onward flow and retardation of the current, namely, *conduction* and *resistance*, and let me tell you at once that unless you make yourselves thoroughly acquainted with these you never ought to apply electricity to the human body.

It is a very simple matter for all we want to know of it, but to the advanced scientist it is still a matter of almost unfathomable importance.

The *conduction* of the current is dependent upon the *resistance* which it encounters. The *strength* of the current is evidence of the quantity of electricity flowing at a *given rate* in a *given time*, which is determined by the *electro-motive force* in the cell, and by the diameter, length and purity of the wire or rheophore. The *strength* of a current must be relative to the *difference of potential* of the element in the cell to which the electro-motive force of the cell is due, as well as to the *conductors* in circuit.

RESISTANCE is the reciprocal of CONDUCTIVITY. In speaking of the electrical transmission of power we know that it is dependent upon the medium through which the current is transmitted, that is, to the resistance which this medium offers to its conductivity; therefore for practical purposes and for *measurement* we consider certain standards of known *resistance*, and for this reason we speak of *resistance* rather than *conductivity* of the electric current.

Electrical resistance weakens the current.—The strength of a current depends upon the initial force—*the electro-motive force*—set up in the battery, and the resistance which the current meets with in the battery and in the external circuit, and is expressed thus, $S = \frac{E}{R}$ when S = current strength, E = electro-motive force, and R = resistance.

The electro-motive force varies with the greater or less difference of potential of the plates, and depends upon the substances used for plates and the solution acting upon the positive plate.

The resistance consists of external or wire resistance, and internal or liquid resistance, and the above equation may be expressed, $S = \frac{E}{l + w.}$

The liquid resistance varies for different liquids, and also directly as the distance asunder of the plates, and inversely as the size of the plates.

The wire resistance varies directly as the length and inversely as the area of cross section of the wire (or as the diameter of the wire). The rules for variation of liquid and wire resistance are identical, for distance asunder of the plates equals *length* of liquid, and area of plates equals *area of cross-section* of the liquid.

When two or more cells are joined abreast, copper to copper, zinc to zinc, to form one compound cell, the effect is not to increase the electro-motive force, but to enlarge the area of the plates, and hence to reduce the liquid resistance.

When two or more cells are joined in *series*, copper to zinc, the electro-motive force is multiplied by the number of separate cells; but the liquid resistance is also multiplied by the same number, for the current has to traverse each cell in succession.

A battery works to best advantage when the external and internal resistances are equal. Generally for strength in electrolysis, &c., the series arrangement is best; for heating wires the compound arrangement is best.

Prof. Ayrton in his lecture before the members of the British Medical Association, at Bath, last year, "On the Electrical Transmission of Power," made the following practical remarks, which may enable you to comprehend more fully what I am about to tell you:—

"Let us study this electric transmission a little in detail. I pull this handle and the bell at the other end of the room rings, but in this case there is no visible motion of anything between the handle and the bell. (Electric bell rung by an electric current produced by pulling the handle of a small magneto-electric machine). Whether I ring the bell by pulling a wire, or by sending an air puff, or by generating an electric current by the exertion of my hand, the work necessary for ringing the bell is done by my hand exactly as if I took up a hand bell and rang it. In each of the three cases I put in the power at one end of the arrangement, and it produces its effect at the other. In the electric transmission how does this power travel? Well, we do not know; it may go through the wires, or through the space outside them. But although we are really quite in the dark as to the mechanism by means of which the electric power is transmitted, one thing we do know from experience, and that is this—given any arrangement of familiar electrical combinations, then we can foretell the result."

Now my object is to be practical, simply practical. I am anxious that the *current* of thought and ideation *shall be complete* between my brain and your own, that the difference of potential of my brain shall engender ideational force which shall be transmitted or conducted by intellectual media in such a manner that it overcomes any resistance which is normally associated with the highest intellectual capacities, and so equalize our potentialities of thought that no further current can be called into existence.

The seat of the electro-motive force in a cell has given rise to, and is still a subject of, controversy. There is no doubt whatever that at every contact between *dissimilar materials* an abrupt change of *potential* occurs, and that the algebraic sum of all these changes, when the two terminals are of the *same material*, is the final *electro-motive force*. The electro-motive force of a cell is a *measure*, and may be considered as the *cause* of the *energy* of the *current* it supplies. Mere contacts *cannot* be sources of *energy*. All work done by a cell, whether in the form of *mechanical* work or of its equivalent *heat*, is the *result* of chemical changes occurring. Since work can never be created or destroyed, the energy (including heat) of the current must be *equal* to the energy of the chemical change producing the current. For instance, when a current is passed through water the liquid is decomposed, and its constituents, *oxygen* and *hydrogen*, escape. To tear these gases apart, and set them free, requires exactly so *much work* as is equivalent to the heat that they can produce on recombining.

I have in my hand two ordinary electrodes. They are made, as you see, of wooden handles to which are attached brass cups, and in these brass cups are pieces of wetted sponge. I attach the terminal wires of the galvanic cell to the brass cups, having my galvanometer *in circuit*; now I bring the wooden handles in contact, and if you watch the needle of the galvanometer you will see that it is motionless, the electric current cannot pass through the wood because it is a *non*-conductor, its power of *resistance* is complete. I now bring the sponges into *contact* and make the current entire, and you see it is complete by the deflection of the needle. Instead of bringing the sponges together to complete the circuit, I now bring the brass cups together, and you will see that the needle of the galvanometer is much more active than before when I brought the sponges into contact. What does this teach us? Merely that the *conducting* power of the sponge is less than the conducting power of the brass; or, in other words, the *resisting* power of the sponge to the current is greater than that of the brass. Here, then, we have very definite examples of the comparative difference of *resistance* between the sponge and the brass. This *resistance* to the flowing current is, as you see, *external* to the cell, but, as I have before told you, the *current* experiences another form of *resistance in the cell* which is known as the *internal resistance*. Do please bear in mind that every current *in circuit* experiences two forms of resistance, the one in the cell itself, called the *internal resistance*, and the one outside the cell, called the *external resistance*.

ELECTRIC CURRENT.—In order to make ourselves familiar with the electric current we have several points to consider, namely, its energy or capacity for work, "electro-motive force":

The transmission of power by the current in reference to velocity, time, and space, "strength of current": The ordinary modes of determining the strength of the current, and the work which a current is capable of effecting by the power transmitted in overcoming resistance and inertia. Let me first draw your attention to three terms, with which according to their reasoning you must become accustomed. I will do my best to make their meaning clear to you.

Volt, the unit of electro-motive force (a Daniells' cell has an E M F of 0·98 to 1·10 Volt).

Ohm, the unit of resistance.

Ampere, the unit of current strength furnished by an E M F of one volt through one Ohm.

We speak of a battery of so many *volts* as we would of an engine of so many horse power, so that a unit of electro-motive force is defined as that which is *competent* to send a current of unit *strength*, through a unit *resistance*, and thereby send a unit *quantity* in a unit *time*.

A unit current is said to be the current which in passing through a conductor of unit *length* exerts a unit of *force* on a unit *magnetic pole* at a unit *distance*. And a unit of *work*, or its equivalent, is done per second by a unit *current*, passing through a conductor of unit *resistance*.

The velocity of a voltaic current in its transit through a thick iron wire has been shown to be after the rate of seventeen thousand miles per second in an air line.

You may wish to calculate the electro-motive of your battery, and this you can do by means of the galvanometer, for all medical purposes. Twenty freshly charged Leclanché cells will give a deflection of about thirty milliampères if the resistance of the galvanometer is = 1000 Ohms, so that their electro-motive force about equals thirty volts (1·5 volt per cell).

Ohm's law.—The current of electricity will be directly proportional to the *electro-motive force*, and inversely proportional to the resistance in the circuit, or mathematically expressed, $C = \frac{E}{R}$; but, as we have seen, the current not only encounters the external resistance say, of the human body, but it also encounters the internal resistance in the cell, therefore we have two resistances, expressed by the following equation:—

$$C = \frac{E}{R} \text{ becomes } C = \frac{E}{R' R''}$$

where R′ is the resistance in the battery and R″ that outside.

The *Ohm*, then, is the unit of *resistance*, and the resisting medium taken is a standard coil of copper wire 1 mm. in diameter and 48·5 m. in length, or a column of mercury 1 sq. mm. in area, 1·05 metre in height, known as a rheostat.

Rheostat has its name from the possibility, by its use, of reducing the strength of a current till it becomes of a certain *predetermined* strength. This it effects by introducing into the circuit a resistance which can be increased or diminished at pleasure. We assume that the *resistance* in a wire increases with the length of the wire; so that if we introduce a certain length of wire into a circuit, we *diminish* the current strength more than if we introduced a shorter wire of the same material and thickness. We have seen that the *total resistance* is made up of the internal resistance R′, that is, the resistance of the battery and the external resistance R″, taking, for example, the resistance of the human body and electrodes.

In order to estimate the *internal resistance* of a cell we note the current strength by the galvanometer and call this C, which, as we know, is the quotient E R (electro-motive force and resistance). We now introduce into the circuit a rheostat and put in resistances until the needle of the galvanometer shows that C is reduced one half. It is evident that the increased *external resistance* must be equal to the *internal*, for since

$$\frac{E}{R'} = 2\,\frac{E}{R' + R''} \quad R' = R''$$

To ascertain the resistance of the *human body* we first note the deflection given when the human body is in circuit; we then replace the human body by the *rheostat*, and so arrange the artificial resistance that the deflection of the needle of the galvanometer is the same as before. This resistance must be the same as that of the body, for

$$C = \frac{E}{R' + R''}$$

In both cases R must be the same.

Again, to ascertain the *definite resistance* of the human body by Ohm's law it would read thus:

$$\frac{\text{electro-motive force}}{\text{strength of current}} = \text{Resistance.}$$

For instance, if we have a rheostat of known resistance, say 800 Ohms, the resistance of the galvanometer being 70 Ohms and that of 5 Leclanché elements 5 Ohms, we calculate firstly for this purpose, the electro-motive force of the 5 cells by the following equation: Strength of current × resistance = electro-motive force. If the deflection of the galvanometer shows 8 mms. ampères it would, under the above-mentioned circumstances, be 0·008 ampères × 815 Ohms = 6·5 volts.

The galvanometer may then be used for testing the resistance of the human body. The electro-motive force of the battery is known as 6·5 volts, the resistance of the galvanometer being 70 Ohms and that of the battery 5 Ohms, the galvanometer showing a current strength of 9 mms. ampères, the total resistance in the current would be

$$\frac{6·5 \text{ volts}}{0·009 \text{ ampères}} = 722,\ 2 \text{ Ohm.}$$

Deducting from this the resistance of the galvanometer and that of the elements, we have 647 Ohms as the resistance of the body.

Various means have been devised for collecting the elements or regulating the current strength by including in the circuit the number of cells requisite, etc.

In practice we measure the strength of the current by the amount of work which it is capable of doing—the strength of the current being dependent, as we have seen, upon its capacity for work varying according to the quantity of fluid conveyed in a unit of time through any sectional area of the channel.

AMPERE.—The unit of *current strength*, and by *Ohm's law* is that of a current furnished by an *electro-motive* force of one *volt* through one *Ohm.* Now, if you please, let me make this clear to you. We have before us connected in succession a *voltameter* and a vertical *galvanometer*, we also have a solution of *potass iodide* on one part of this plate and some *white of an egg* on the other part. I now connect one of my wires to a Stöhrer's continuous current battery, the elements of which consist of a series of zinc and carbon plates dipping into a weak solution of sulphuric acid (1 in 10 parts of water), and the other wire I attach to the galvanometer. The voltameter is connected also with the battery and the galvanometer. This which I move up and down on the top of the cells is termed a *sledge collector*. It runs, as you see, in a groove, and carries on its inferior surface two springs which come successively into contact with these metallic pieces arranged in two rows. To these pieces the wires from the cells are attached. The sledge, if you observe, carries on its upper surface two binding screws connected with the springs to which I have attached my *rheophores;* the handle works upon what is called the band *commutator* or current *reverser*. By means of this I can *reverse* the current from negative to positive, or *vice versa*. The alternations or reversions of the current are known as *voltaic alternatives*. When the handle is vertical, as you see it now, no current is flowing, it is said to be *broken* or *opened* (break or opening). When I put it *so*, or *so*, either to the anode or kathode, the current is allowed to flow; it is then said to be *made* or *closed* (make or closure). We shall refer to this again when speaking of the effects of the current upon the human body.

To the ends of the rheophores I attach these two needle electrodes, and I set the current in motion. I want to demonstrate to you successively the effect of the current, first upon the *voltameter*, which I shall explain, secondly upon the *galvanometer*, which I shall also explain, thirdly its effect upon the iodide of potass, fourthly its effect upon the albumen of the egg, so that we shall in this manner be able to ascertain the *strength of the current* and the mechanical, chemical, and physiological work of which it is capable. It is my usual practice in these lectures to adopt this mode of procedure because it enables me to bring before you almost every point of interest in reference to the current itself—its strength and the power which it possesses in overcoming *resistances* according to the capacity of its electro-motive force.

A VOLTAMETER is an arrangement in which the chemical action of the current furnishes the index of its strength. The voltameter which I have here is known as Gaiffe's; it is figured and described very accurately by Dr. de Watteville in his book entitled "Medical Electricity," so that I will give you his own words, which are sure to be correct. But before I do so, let me tell you that when I pass the current through the water, if it is of sufficient strength, it will decompose it into its constituent elements, namely, "oxygen" and "hydrogen," in the proportion of one volume of the former to two volumes of the latter. The gases will ascend in two columns of bubbles of unequal size; the lesser, the "oxygen," will be given off at the *anode* or positive pole, whilst the larger, the "hydrogen," will be given off at the *kathode* or negative pole. As the gases rise so the water is displaced in the inner tube. Now let us have de Watteville's description of this instrument.

"A voltameter has recently been constructed by Gaiffe which is calculated to fulfil many of the requirements of the physician desirous of acquiring the means of estimating the strength of his battery, or of the currents he uses for therapeutical purposes. The instrument is represented in *Fig.* 38 and is used as follows: The tubes are filled with water and the corks fixed to their respective mouths. The current led by the platinum wires or 'electrodes' decomposes the water into oxygen and hydrogen, which ascend in the inner tube and collect at the top. When the inner tube is filled with gas, the inner cork is lifted out by means of the wire, the water enters into the inner tube from the outer, and the instrument is ready for further measuring. Now and then a little water has to be poured into the instrument, so as to secure the refilling of the inner tube when the cork is raised. This voltameter is a cheap, simple, and reliable instrument for estimating the strength of currents, the electromotive force of the battery, and the resistance in circuit. But its applicability is limited to cases where the current is allowed to flow for one or more minutes. For the measurement of currents of short duration, such as are used in electro-diagnosis, for instance, a galvanometer is necessary. A few examples will assist the reader in realizing the method of measuring electrical magnitudes by means of the voltameter.

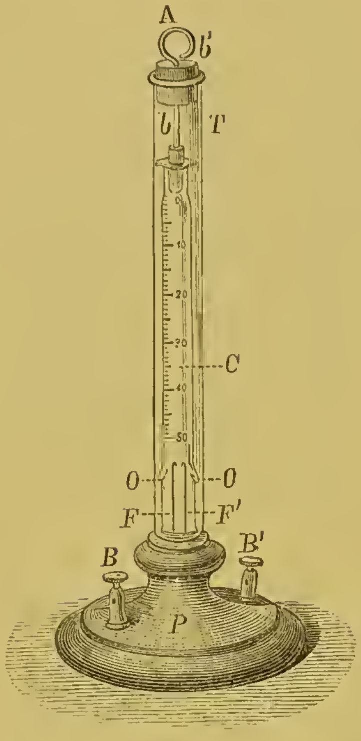


Fig. 38—T outer tube, C inner tube, both fixed to a stand, P.—*b* and *b'* corks closing the upper extremities of the tubes. *b* can be lifted out of the inner tube by pulling the wire A which passes through the cork *b'*.

O, O' apertures in the inner tube; FF' platinum wires projecting into the inner tube and connected with the binding screws BB' to which the wires of the external circuit are attached.

The inner tube is graduated, so as to indicate the volume of gas set free in cubic millimetres.

Place the voltameter in circuit with the battery and the human body. Note the amount of gas collected in the graduated tube, during any one minute, (1st, 2nd, 3rd,...10th, 11th, etc. minute). Since 1 milliampère of electricity sets free 10·3 cubic millimetres of gas per minute, we have, in order to know approximately the strength of the current at any time, only to divide the number of c.mm. of gas set free during one minute by ten. Or if we want to know the total amount of electricity used during a certain number of minutes, to divide the total number of c.mm. of gas set free by ten.”

I now close the current, and you see the chemical combination of the gases is overcome by the power transmitted by the current; the gases are being liberated, collecting and displacing the water in the inner graduated tube. But now I want you to notice the deflection of the needle of the galvanometer caused by the current which is in circuit, as well as its effects in the electrolytic liquid of the voltameter. If we worked it out carefully we should find that the amount of chemical work done, that is, the amount of decomposition effected, is directly proportional to the current strength as measured by the galvanometer.

Galvanometer.—The galvanometer is an instrument having a magnet freely suspended or pivoted in the centre of a graduated disk, which is easily acted upon or deflected by the passage, in *its neighbourhood*, of a current of electricity in a coil of insulated wire; hence, if a magnetic needle be suspended, and a current be passed either *over* or *under* it, the magnetic needle is turned or deflected from its *north* and *south* position to a direction east and west, in direct ratio with the strength of the current.

A current from *south* to *north over* the needle causes a deflection of the north point to the west. A reverse current *under* the needle, that is, from *north* to south, *also* causes a deflection *west.*

A current from *north over* the needle *south* causes a deflection *east.* A reverse current under the needle, that is, from *south* to *north*, also causes a deflection east.

It is clear, therefore, that a magnetic needle affords the means of testing the *presence, direction*, and *strength* of *current.* The strength of current is ascertained by the number of degrees through which the needle is deflected, but it is remembered in making galvanometers that the angle of deflection does not increase proportionally to the current strength, and this is instanced by the fact that whilst a current of 30 ma. deflects the needle to about 45°, a current of 150 ma. is required to deflect it to 70°; of course, also, the magnetic influence of the earth has to be taken into consideration.

Equal deflections on the *same* galvanometer always indicate currents of the *same* strength. The galvanometer enables us to calculate the strength of an electrical current by the amount of deflection of the magnetic needle, this amount bearing a certain proportion to the force exerted by the current in overcoming the directive influence of the needle upon the earth.

The one-thousandth of an *ampère*, known as the MILLIAMPÈRE, is the working unit as applied to our medical galvanometers, and we have to thank Dr. de Watteville for its introduction. He says, "This unit exactly suits the requirements of medical practice, for a current of one *milliampère* is that given by three Daniell's through the average resistance of the human body—that is, through parts of medium resistance and through medium sized electrodes. Again, no system of measurement is likely to be adopted unless its unit has a convenient name, and it is obviously easier to record strengths of 1·5 or 15 ma. than strengths of ·001·005 or ·015 of an ampère. We have a parallel instance in the use of the metre and millimetre. Experience shows that applied with medium sized electrodes *medical currents range* between 1 and 20 milliampères, hence we may conveniently designate such currents as 'very weak,' 'weak,' 'moderate,' and 'strong,' according as they range from 1-5, 5-10, 10-15, 15-20 milliampères respectively; 'very strong' currents would in this classification range between 20 and 40 ma."

The galvanometer which I now have in circuit is called *vertical* as distinguished from another form called the *horizontal* galvanometer. The work done by the current in deflecting the needle of the vertical galvanometer consists in overcoming the force of gravity acting on the needle instead of the direct magnetic force of the earth, as is the case in the horizontal galvanometer.

This instrument, which I now show you (*Fig.* 39), is called Dr. Edelmann's pocket galvanometer; it indicates up to 30 ma.; if constructed only for galvanization it indicates by one-tenth of a ma. up to three, and thence by single ma. up to thirty ma. If the apparatus is to serve for electrolysis as well as for galvanization, it is so divided that it indicates by single ma. up to 25 ma. and thence by divisions of 10 ma. up to 250 ma. Mr. Schall tells me that these instruments are divided to meet the horizontal intensity of London, and the greatest error in their divisions is guaranteed not to exceed five per cent. If, for instance, a galvanometer of this kind indicates 10 ma., the actual value of the current measured by the most sensitive apparatus would prove to be not higher than 10·5, and not lower than 9·5 ma.

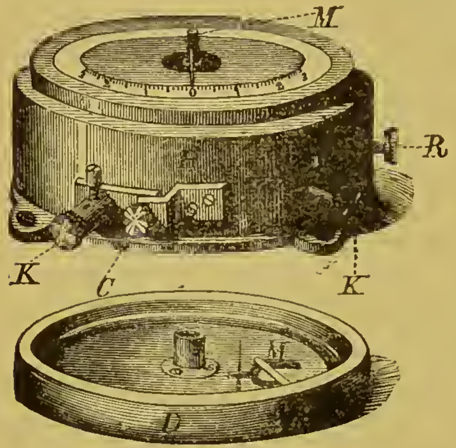


Fig. 39.

The magnet oscillates inside a solid copper block, in consequence of which the needle after two or three short oscillations takes its proper position.

In horizontal galvanometers the deflections depend upon the strength of the current, the intensity of the local terrestrial magnetism, where the galvanometer is used the inertia of the needle which has to be overcome, *but not upon the amount of magnetism of the magnet itself.*

The *inertia* is slightest in the case of instruments, the magnet of which is suspended on a cocoa fibre. I have such a galvanometer here, Dr. Edelmann's Universal Galvanometer; it has a copper damper acting so perfectly that after two oscillations the needle takes its proper position. From 0 to 8 the instrument indicates every tenth part of a milliampère, and even the hundredth part of a milliampère can be determined; it shows the milliampères one by one from 0 to 80, and ten by ten from 0 to 800. The greatest error is guaranteed not to exceed 0·5% (*Fig.* 40).

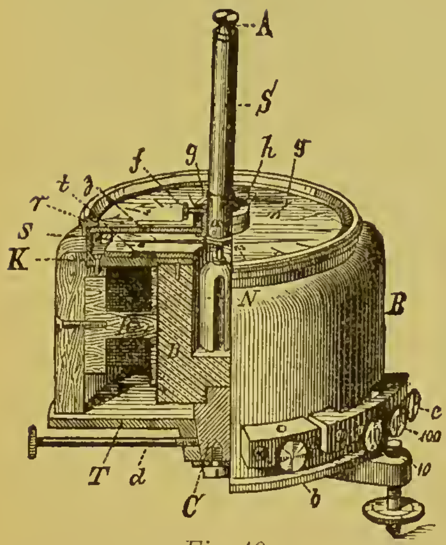


Fig. 40.

This instrument has the great advantage, that in its graduation, being correct for a certain locality, it will always remain so.

This instrument (*Fig.* 41), is the same construction in another shape. In order to enable the operator to read the indications of the instrument from a distance, the scale is vertical and very large; the index, a straw, is bent at the end in a right angle. Owing to its large diameter and glass cover, the instrument is not portable, but very convenient for the consulting room of the physician.

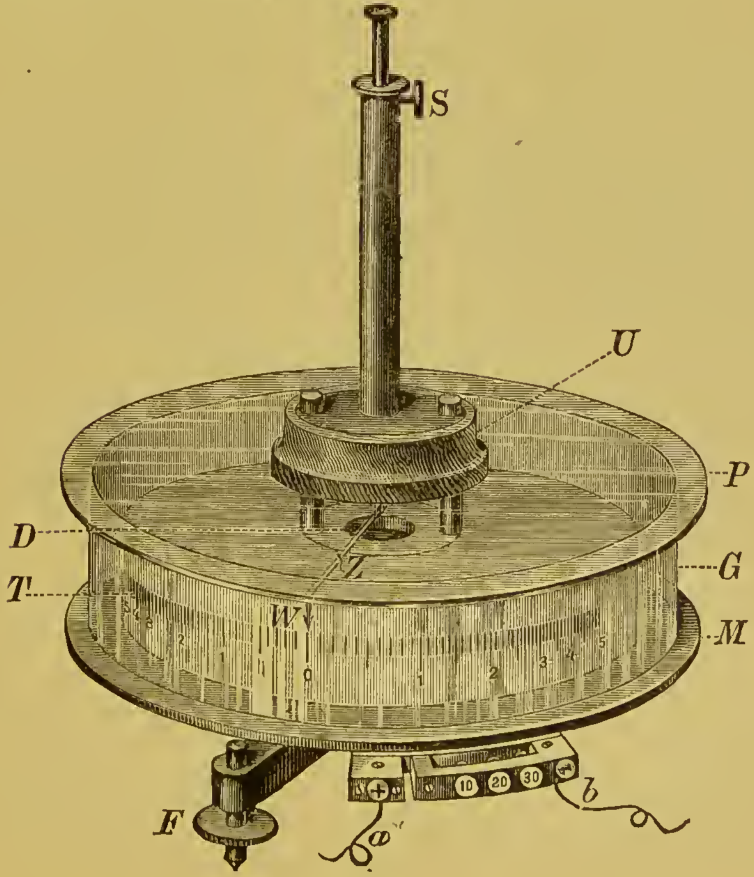


Fig. 41.

I have just said the galvanometer before you has its magnet vertical, and you see the needle is at rest and vertical, for the current is shut off. The deflections of the needle are dependent upon the strength of the current, the dip and magnetism of the needle. I now turn on the current, and I would ask you to denote the deflection of the needle. You say the needle moves to the right and it points to 10. This shows me that I have a current passing of 10 milliampère strength, just the strength of current you use for ordinary medical purposes. I now reverse the current, and you see the needle moves in the opposite direction, but it still points to ten. The strength of current is exactly the same, but it is now travelling in the opposite direction to what it was before, and influences the needle as I have previously explained to you. If I increase the strength of the current you will see that the magnet is more deflected, and by the dial you can read off the strength of the current whatever it may be.

Now let me call your attention again to *current resistance.* You see the electrodes, which I have at the ends of my wires, are simply steel needles, so that I have scarcely any external resistance. I take this flat wet electrode (a piece of zinc covered with chamois leather) and I stick one needle into one end and the other needle into the other end; I turn on the current, and you observe the needle of the galvanometer instead of registering 10 only registers 5 milliampères, so that the resisting power of this pad must be equivalent to so many units of resistance, which we have no need here to calculate. Thus far I hope I have made clear to you for *practical purposes* the nature and the value of the voltameter and the galvanometer. We proceed now, if you please, to note the effect of the current upon this clear white solution of iodide of potass. You know that this salt is composed of a reddish brown element known as iodine, and the element potassium in chemical combination. I now dip the points of the needle electrodes into this solution, and the result shows that the electro-motive force is far stronger than the chemical force, and the elements are liberated. The iodine, you see, by its red colour is found at the *positive* pole, or *anode,* and the *potass* at the *negative* pole, or *kathode.*

Here I have some white of an egg with which you are familiar, I transmit the current into this albuminous substance, which is composed of four elementary bodies, namely, carbon, hydrogen, nitrogen, and oxygen. It forms the chief part of muscle, nerve, and gland, and occurs in all the fluids of the body, including the lymph, blood, and serous fluids. Now notice the electrolytic effect of the current. You see the *kathode* is becoming coated with a dense opaque mass, whilst the *anode* is left free. But this is not actually the case, the water (H O) of the albumen is decomposed, oxygen is set free at the *anode*, and hydrogen with other products at the *kathode*; the action of the *kathode* is decidedly *catalytic* compared to the *anode*. I want you to observe the galvanometer whilst the points of the needles are at the edge of this albuminous mass. You see the deflection is greatly decreased, owing, of course, to the resistance which the mass presents to the current, and to polarization of the electrodes which weakens the current, just as polarization within the cell does. Now this leads me to a practical point. If instead of albumen I were operating upon a tumour, and I directed my assistant to employ a current strength of so many milliampère, I should mean that the galvanometer should register this number of milliampères after the needles were inserted into the tumour. But this subject I shall refer to again when speaking of the electrolysis of tissue, but remember once more that the *kathode* is *catalytic*, and that the anode may be placed upon an indifferent part of the body. *By these four simple experiments we learn that the current of electricity can decompose water, influence the magnet, decompose chemical salts, and destroy organic matter; and we can calculate by means of the galvanometer the exact quantity of electricity or its electromotive force which is necessary to bring about these results; therefore the importance of the galvanometer as a mode of measurement cannot be overestimated.* By the use of the galvanometer in circuit you are quite independent of the state of your battery, because it must be evident to you, after a moment's consideration, that the electro-motive force of the cells and their internal resistance differ from time to time in the same battery, and from one battery as compared with another. Sensory and motor phenomena are so variable that they cannot be relied upon. Dr. de Watteville very truly observes that, "A few days spent in observation with a cell, a rheostat and a galvanometer will save many a misunderstanding, and make a man a better electrician than as many months reading about 'Ohm's law and its consequences.'" Let me tell you this much, do not think you know anything practically about electricity until you have dissected a battery, rheostat, galvanoscope, and primary and secondary coils of an induction apparatus, and found out for yourself how they act and react, the one upon the other. I spend many a quiet hour in this way with great pleasure, satisfaction, and instruction.

There are one or two other points in connection with the galvanic current to which I should like to allude. We speak of the CONSTANT current as regards its *constancy*, *regularity*, *maintenance* and *persistency*. You know a battery cannot go on working for ever: like everything else in action it must suffer from wear and tear, and the greater its activity the more rapidly does it become *exhausted*. But as the battery becomes exhausted, the current gets irregular, and fitful: this usually depends upon a deficiency of *chemical action*, a diminution of *potential* and *electro-motive force*, increase of *internal resistance* and *polarization*.

Polarization—of which I don't think I have spoken to you—is due to the evolution of hydrogen and oxygen in the cell from the electrolysis of the water, the oxygen going to the zinc and the hydrogen going to the carbon. In the Leclanché cell, for instance, the carbon plates are mixed with peroxide of manganese, and the latter substance is also put in the cell in order to remedy this very serious defect. If this is not done a counter-current is generated from the hydrogen to the oxygen which may be strong enough to neutralize the original current altogether. Take a simple cell with copper and zinc elements and watch the copper plate during action; it quickly becomes covered with a film of hydrogen bubbles, which adhere to its surface, a very few of them rising through the liquid. This film (1) offers increased resistance to the flow of electricity between the plates, and (2) sets up a force in the opposite direction, tending to produce a current from the hydrogen to the zinc. The accumulation of the hydrogen bubbles on the negative plate and consequent tendency to *reverse the polarity* is called *polarization:* a cell or battery which shows a great loss of current strength due to the presence of hydrogen on the negative plate or plates is said to be *polarized*.

Remedies for Polarization: 1. Stirring the liquid or blowing air through it, brushing the negative plates or lifting them out of the liquid frequently, might get rid of the hydrogen by *mechanical* means, which, however, would be troublesome, and would interfere with the course and strength of the current. A better contrivance is *Smee's Battery*, which has zinc and platinized silver plates immersed in dilute sulphuric acid. The silver plates are sprinkled with fine platinum; this forms points upon which the bubbles collect, and from which they freely ascend to the surface of the liquid. Smee's is a handy, compact, single-liquid battery, but is rather expensive.

2. Certain substances—such as bichromate of potash and bleaching-powder—if added to the acid, unite with the hydrogen, and prevent the film by *chemical* means. If used with copper they would also unite with that metal; hence, with these substances the negative plate must be platinum or carbon. The *Bichromate Battery* is a useful form, consisting of zinc and carbon plates in a mixture of dilute sulphuric acid and bichromate of potash. Usually a single cell is fitted with three or five plates so arranged that the two sides of each zinc

plate are opposite two carbon plates. This solution acts on zinc when the circuit is open; provision is therefore always made for lifting the positive plates out of the fluid when the battery is not in use.

THE RESISTING POWER OF THE HUMAN BODY to the electric current is more or less a negligible quantity, and this must be the case. When we take into consideration that the epidermis varies as a resisting medium according to its density, its thickness, its vitality, and its dryness or moistness, we are not astonished when we hear that the resistance of the human body is something varying between 1000 and 10,000 Ohms. Perhaps if we set down the resisting power of the human body as between 2500 and 3000 Ohms, we shall be fairly within the mark.

In determining the measure of resistance it is, of course, necessary to bear in mind that each tissue has its own resisting power, the epidermis having a greater resistance than all the other tissues put together, in fact, the epidermis may be almost looked upon as an insulator; broadly, we shall not be far wrong in stating, that in point of resisting power the tissues may be arranged thus: 1st, Skin; 2nd, Fat and areolar tissue; 3rd, Muscle; 4th, The contents of the blood vessels. If you are anxious to compare the resisting power of the epidermis with that of the skin, make a scratch upon your finger, place one flat electrode from a faradic battery at the back of your patient's neck and another at the back of your own, increase the current to a comfortable degree of strength as felt between the normal epidermal surfaces of both your patient and yourself, now apply the raw surface of your scratched finger, and the resistance will be so lessened as to make the current painful, not only to yourself, but to your patient. It is computed that the body resistance (subepidermal) is about 500 Ohms, but here again there is considerable difference of opinion, and even practically under the same given conditions. The galvanometric readings differ, but I have upon more than one occasion been astonished at the loose way in which these examinations have been made, even for statistical purposes. A very little pressure more or less upon the skin by the electrode will alter the deflection of the magnet. In the electrical treatment of uterine fibroids, according to Dr. Apostoli's mode of procedure, when the needle is inserted into the body of the tumour, the resistance is usually from 350 to 400 Ohms.

As the resistance of a conductor varies inversely with its diameter, it is only fair to assume that the resistance of the skin will be diminished by doubling, trebling, etc., the size of the electrodes. The resistance of the body will vary not so much according to the distance of the electrodes from each other as according to their diameter. The changes produced in the skin by the galvanic current if too strong, or if applied for too long a time, give rise to two different conditions at the anode and kathode respectively. Under the *anode* an eschar is formed with an acid re-action. Under the *kathode* an ulceration is produced with an alkaline re-action.

Faradism.—Faradism or faradisation is named after our great scientist, the late Faraday. He discovered that a galvanic current which varied in its strength had a similar effect upon a neighbouring circuit, so that the current produced in the neighbouring circuit has been called a secondary or induced current. *That is to say, the secondary current is a current produced in a closed circuit by the influence of another current either galvanic or magnetic.* When the galvanic current is the *inducing* agent the *induced* current is called *Galvano-faradic;* when the magnet is the inducing agent, the induced current is called *Magneto-faradic.* The magneto-faradic machines are now rarely used for medical purposes. They consist mainly of an armature of soft iron revolving in front of the poles of a horse-shoe magnet and a pair of coils of insulated copper wire.

We have, therefore, two currents to consider, the *primary, extra,* or *inducing* current, and the current *induced,* or *secondary* current. If a *spark* discharge of *frictional* electricity is sent through a wire, a neighbouring closed wire circuit in close proximity is simultaneously traversed by a discharge capable of leaping across a breach in the *second* circuit and igniting gun cotton. Further, the *secondary* discharge so produced is itself able to cause a *tertiary* discharge in a *third* wire. Again, if a *magnet* is moved in the *neighbourhood* of a closed metal circuit, such as a ring, a current of electricity is generated in that circuit of metal. We now consider by the help of this diagram (Fig. 42), galvanic induction phenomena similar to the frictional electric induction phenomena just described. A galvanometer (G) having been tested to see what direction of motion of the needle corresponds to the passage of the electricity in at one terminal, is attached to a straight wire (S). Another straight wire (P) can be fastened to the poles of a battery, and, by means of a rheotrope, the current in P can be started, stopped, or reversed. The following relations im-

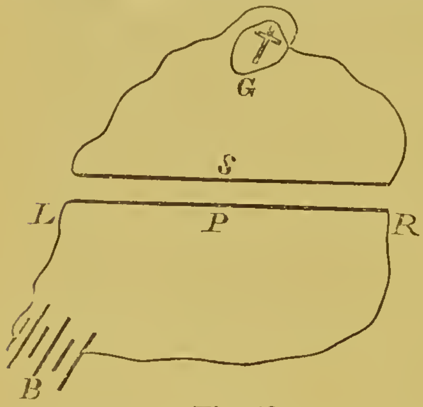


Fig. 42.

mediately declare themselves. When a current is started in P from left to right, the galvanometer needle turns in such a direction as to show that a current passes through S in the opposite direction. The current in P being continued from L to R, the current in S ceases. On stopping the current going in P from L to R, a current traverses S also from L to R, but immediately ceases. If the current be now started in P from R to L a momentary current from L to R passes along S. On stopping the P current from R to L, a current from R to L passes along S. So that, in general terms, the current in the secondary is in the opposite direction to that of the primary when the primary is started; when the primary is stopped the current in the secondary is in the same direction as that in which the current flowed before stoppage in the primary.

Strength of Induced Currents.—The strength of an induced current depends upon the strength of the inducing current, its nearness to the induced current, and the length of the opposed parts. The induced current, other things remaining the same, varies directly with the strength of the primary current, both when the latter is started or stopped. It varies also as the product of the lengths of the two currents. Accordingly, the strength of the induced current is much exalted, if its folds of wire are many and parallel to the many folds of wire of the primary.

Electricity induces Magnetism.—Not only will magnetism induce electrical currents, but electricity will induce magnetism. Take a piece of soft iron—a poker will do—make a coil round it with insulated wire connected with a battery. The wire may be covered, or paper may be rolled round the iron to keep the current from passing to it, since the action is to be induction. Immediately on starting, and *during the whole time of the flow of the current,* the iron becomes and remains a magnet. If we dip into iron filings the wire of a closed circuit having a strong current passing through it, the filings around become magnetic, and cling together in masses round the wire, as if it were magnetic also.

Temporary and Permanent Magnetization by Electricity.—With soft or wrought iron, the magnetism ceases when the current is stopped, and we have a *temporary magnet.* With steel, the magnetism, or a large portion of it, remains after the current has ceased, and we have a *permanent magnet.* Soft iron is more readily and more strongly magnetized than steel by a current circulating around it, and electro-magnets are usually temporary magnets. They are used to impart their magnetic properties to steel in the manufacture of permanent magnets, to obtain induction currents, and in telegraphy.

In the ordinary apparatus for *current induction* we have two separate and distinct coils of wire wound round a reel. (1,) The *primary* coil, for the *primary* or *extra* current is usually made of much coarser wire than that for the *secondary*, and is wound round the reel first. (2,) The *secondary* coil, for the induced current is usually made of much finer wire than that for the primary. When the wires are thoroughly insulated they can be adapted to the same reel. (3,) The *core*, which consists of a bundle of soft iron wires of equal lengths, fills the hollow of the cylinder and projects a little outside the hole of the reel. A soft solid iron core may be used, but the wires are capable of stronger magnetization. The core may be either (1) fixed or (2) fitted so as to be wholly or partially withdrawn, or (3) covered with a brass tube which may be withdrawn at pleasure so as to expose the whole or part of the core to the *inductive* influence of the primary. Thus far we have our coils of wire, *primary* and *secondary*, wound round one reel, and the *magnet* fastened on one block of wood. We must now have a contact-breaker and a bichromate or Leclanché's cell. Two binding screws are fastened to the wood for receiving the wires from the Leclanché cell. To one of these binding screws *one* end of the primary is joined. The other end of the primary is fastened to the pillar which carries the screw of the contact-breaker; a wire between the other half of the contact-breaker and the remaining binding screw completes the circuit. The *contact-breaker* consists of two parts, of which one carries an iron *hammer head* upon a spring, the other has a screw with a *platinum point*. The *hammer* is fixed on the same block of wood as the wire *coil* and the *core*, so that the head of the hammer is about a quarter of an inch from the end of the core. The screw is fastened so that when at rest it touches the head, and is so arranged that by turning the screw the head may be pressed nearer the core when necessary.

Explanation of figure for demonstrating galvano-induction (*Fig.* 43).—The wires of the Leclanché's cell (LC) generating the *primitive* (not primary) current are attached to C C, and the galvanometer (G) is attached by the *primary* current wires to P P, or it may be attached to the secondary current wires SC′ SC′. The current may be made or broken at B.

The *primary coil* (PC) is attached by its two extremities (1) with P and P, and (2) with the *stud* under B and C. The *spring* at B when pressed down connects the stud with C. The letter M denotes the soft iron rods for *magnetization* which are placed in a hollow space surrounded by the *primary coil* (PC) The letters S C denote the *secondary* coil, and the extremities of the thin wire which is bound round it are connected with the binding screws (SC′ SC′). Of course the *secondary coil* (S C) is hollow so that it may fit over the *primary coil* (P C). The

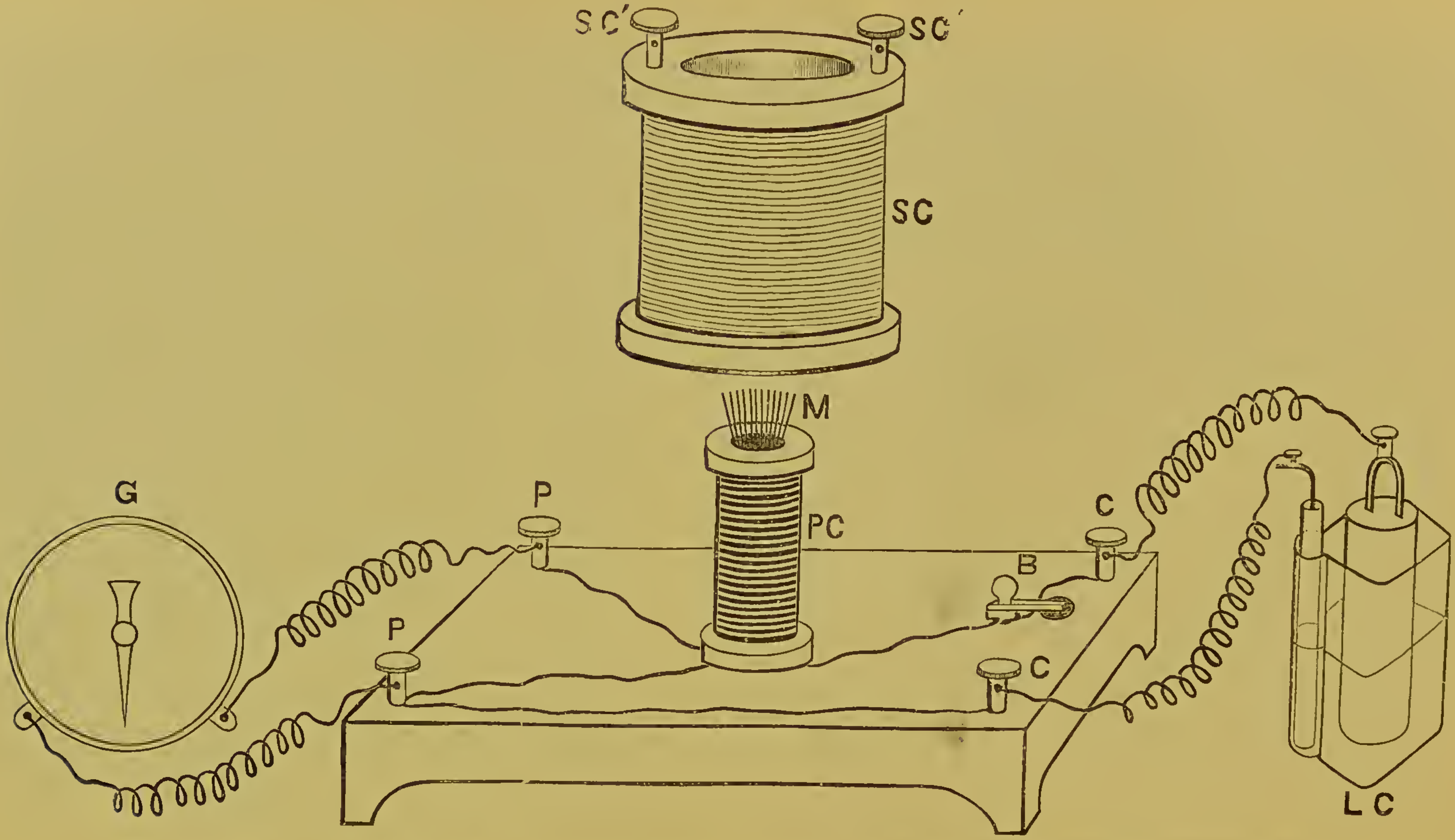


Fig. 43. Figure for demonstrating the galvano-faradic or induced current. See explanation on opposite page.

primary current through P C is alternately made and broken by means of the spring (B). Therefore the *primary* or *extra* current is obtained at P P, whilst the secondary or induced current is obtained at SC′ SC′ through the binding screws at the top of the *secondary* coil.

The induction current from the secondary coil (S C) is always increased with the strength of the current in the primary coil (P C) and of the intensity of the magnetism in M, and, as before observed, the two currents increase according to the number of turns in the wires in the primary coil (P C) and the secondary (S C), and the juxtaposition entire or in part of the secondary coil (S C) with the primary (P C). From this description, and from the plate, we see that a galvano-faradic machine consists of a battery (L C) generating the *primitive* current of an interruptor (B) of a *primary* coil of thick wire (P C), of a bundle of iron rods inside the primary coil and of the *secondary* coil (S C) made of thin wire.

Action of the Induction Coil.—The terminals of the secondary wires are brought near one another; the binding screws connected with the primary are joined to the battery wires, either through the commutator or directly. (1) A current sweeps round the primary, which both converts the core into a *magnet* and induces a momentary *reverse current* in the secondary. (2) The sudden magnetization of the core would alone start a reverse current in the secondary; its effect is therefore to *strengthen this secondary current.* (3) This magnetization also attracts the hammer of the contact breaker and *stops the current* by breaking the connection between the hammer and the screw. (4) This stopping of the current causes a demagnetization of the core—a direct current in the secondary, due to the ceasing of both the primary and the magnet—a return of the hammer-head to the screw, since the head is no longer attracted, while the tension of the spring restores it to its place. A second current now passes through the primary, and the whole process is repeated. The hammer vibrates *automatically, i.e.*, of its own accord, or rather as the result of the action of the instrument; each *make* of contact causes a reverse current, and each *break* of contact causes a direct current in the secondary. The result is a rapid series of momentary secondary currents which overleap the space between the terminals or electrodes, and appear as bright sparks. When the hammer is held by the hand and made to vibrate very slowly, the separate sparks, due to make and break, may be seen.

It may be also noticed that the spark on break of contact is stronger than on make of contact. This is the effect of the *extra current* which *weakens* the primary on *starting* and *strengthens* the primary on *stopping*. The difference is seen at the platinum screw of the contact breaker. The great heat of the spark on break of contact rapidly spoils the end of the screw unless it is made of platinum, which is very difficult to fuse.

At each make of the galvanic current we have two *induced* currents, the *self-induction* in the coils of the *primary* wire *itself*, and the secondary induced current in the secondary coil of wire, opposed to it in its direction. *At each break* there are also two induced currents flowing in the same direction as the battery current; from this it is rightly inferred that the primary induced current is weaker than the secondary induced current. What we say is, the finer wire in the secondary coil gives a current of higher tension. Dr. Apostoli speaks of a faradic current of high tension; this really means, as far as I understand it, that the induced current is made to pass through in the secondary coil a series of loopings of very fine wire.

This little faradic apparatus, which I now show you, is made by M. Gaiffe, of Paris, and its great advantage is its portability. The galvanic current is generated from these two chloride of silver cells, and the secondary coil for the secondary current is made up of two parts, and reversible, so that the secondary current obtained from one part is of a higher tension than that obtained from the other part. In point of fact the wire of one coil is much thicker than that of the other coil. The current obtained from the thicker coil of wire is superior for the purpose of stimulating the muscles through the wetted skin where the resistance is less, whilst the current obtained from the finer wire is used for exciting the dry skin where the resistance, as you know, is very great.

The little faradic battery I now show you (*Fig.* 44) consists of an induction coil with commutator for primary or secondary current. The exciting fluid is a solution of chromic acid, and it is very convenient and portable, and quite powerful enough for all ordinary purposes. It is put in or out of action by raising or depressing a stem at the back of the box which is connected with the zinc plate so as to elevate it above the fluid, the carbon only remaining immersed, or to lower

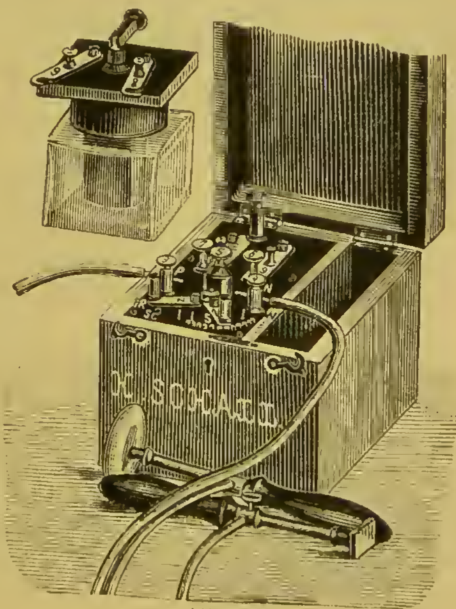


Fig. 44.

it into the fluid and set up galvanic action. The variations of power are here controlled by a small lever moving over a number of brass studs placed as a segment of a circle and in contact with the coil at different points of its length. The mode of charging the battery is as follows. Unscrew the nuts at the side of the piston and turn the bars from under them; take out the back part of the battery and turn the lid round until it comes off; fill the bottle about half full with a mixture of bichromate of potash and sulphuric acid (or solution of chromic acid), replace the cover and the battery; turn back the brass arms and screw the nuts tightly down upon them as before; insert the connecting wires in the clamps and push down the piston, when the battery will act at once. The power of either current is increased by turning the lever from right to left. The piston should be drawn up when the battery is no longer in use, and folded down by means of a hinge adapted to it for this purpose. When the action of the battery becomes feeble throw away the old fluid, rinse the bottle, and pour in a fresh charge. It is very important in all electrical applications to make sure that contact is everywhere complete, and that all the parts are clean, want of cleanliness is often the cause of failure, and the absence of it gives rise to more disappointment and annoyance than is usually believed. If a battery is found to be out of order and no work can be got out of it, the reason will frequently be that some dirt has accumulated between one or other of the connexions, thus severing the continuity of metallic contact; this should be diligently sought for step by step; a very thin film of non-conducting matter will interrupt the course of the current. The bichromate solution should be prepared as follows: Dissolve 3 to 4 oz. of bichromate of potash in 16½ ounces (fluid measure) of boiling water; when cold, or nearly so, add one fluid ounce of strong sulphuric acid. The chromic acid solution is made by dissolving four ounces of Byng's salt in one pint of water. The strength of the dilute sulphuric is usually one part of acid to nine or twelve of water. The solution of ammonium chloride is made by dissolving as much of the salt in boiling water as it will take up, and using the clear fluid when it is cold.

The combined battery which I now show you possesses many advantages (*Fig.* 45). I will endeavour to describe its constituent parts to you. In the lower part of the case we find placed the required number of Leclanché's cells, which are connected together in "series," by means of screws, and a well insulated copper wire unites each single element with one of the pegs of the current selector, which are placed here upon the left side. By turning the crank of the current selector in this manner, the number of the cells in action may be

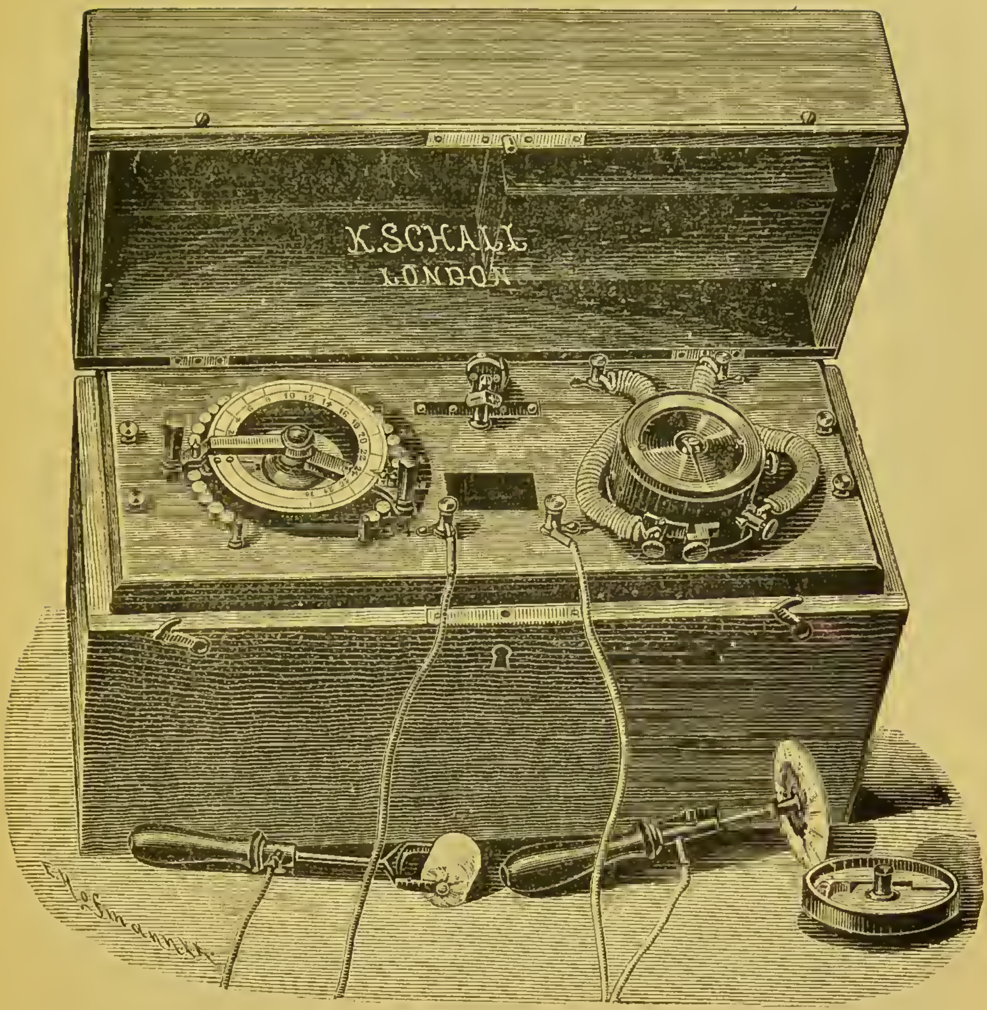


Fig. 45.

conveniently and without shocks increased or diminished, so as to regulate the strength of the current. The current selector is so arranged that you may begin with the last cells as well as with the first, or with any cell you like. The advantage of this is that the first cells shall not be more quickly used up than the last.

In addition, we find provided a current interrupter and a current reverser, and also one of Edelmann's galvanometers which indicates from 25 to 250 milliampères and shows with great accuracy the strength of current passing through the patient.

Mr. Schall tells me the batteries which he is now constructing are provided in addition with a powerful Dubois Reymond sledge coil, whose strength of current can be conveniently regulated, a commutator for adapting the primary current, and Dr. de Watteville's key for obtaining from the same terminals the galvanic or faradic, or both currents combined, without changing the cords. There is certainly one very great advantage possessed by Mr. Schall's arrangement of the Leclanché's cells which one does not find in batteries generally, and this is that they can be thoroughly re-charged by any person without difficulty, thus obviating the troublesome necessity of constantly sending them back to the manufacturer.

Galvanic Cautery.—I wish you to understand that currents of electricity can be caused by heat. This is called *thermo-electricity,* concerning which I have nothing to say to you. My object now is to call your attention to the *heating effects of a galvanic current,* and the best form of apparatus with which I am acquainted to bring about this condition for surgical use, and to which the term *galvanic cautery* is applied. Cauterization has long been adopted by surgeons for the removal of diseased parts by heat; that is by the transformation of *electric energy* into that of *heat energy.* The stronger the electric current, and the greater the *resistance* of the wire, the more intense will be the heat produced, according to what is known among the physicists as Joule's law. "The quantity of heat generated in a certain time in any part of the galvanic circuit is directly proportional to the *resistance* of this part of the circuit, and to the *square* of the strength of the current."

The total amount of heat generated in a battery is proportional to the *amount* of zinc used, and is equal to the quantity of heat which becomes free by the chemical action in the battery. If the elements are short circuited, such as we find them in our cautery batteries, the two electricities neutralize each other in the proportion in which they are generated, without doing any other work than producing heat in the burners, so you see the energy of our battery, finding no other vent, expends itself, and is actually converted into heat. The temperature of the burner depending upon the difference of the heat generated and the heat radiated will be the *higher* the *greater* the current and its own *resistance,* and the *smaller* its surface and power of *radiation,* hence under these conditions we find, as I now demonstrate to you, this burner first passes to a dull red heat, then to a bright red heat, and finally, as you now see, to a white heat. Batteries with the Leclanché's elements are of little use for heat generating purposes, on account of their *internal resistance* being too great, and also that the *chemical action* is too feeble; and for this reason the *resistance* in the battery is reduced as far as practicable by selecting elements with *large* plates, and having resistances diminished as much as possible by closeness of juxtaposition without coming into actual contact. By this method most of the heat generated by the electricity shows itself on the platinum wire. The total quantity of heat generated in the circuit is proportional to the amount of zinc consumed in the battery. You have before you one of Prof. Voltolini's batteries modified and manufactured by the well-known electrician Mr. Schall (*Fig.* 46).

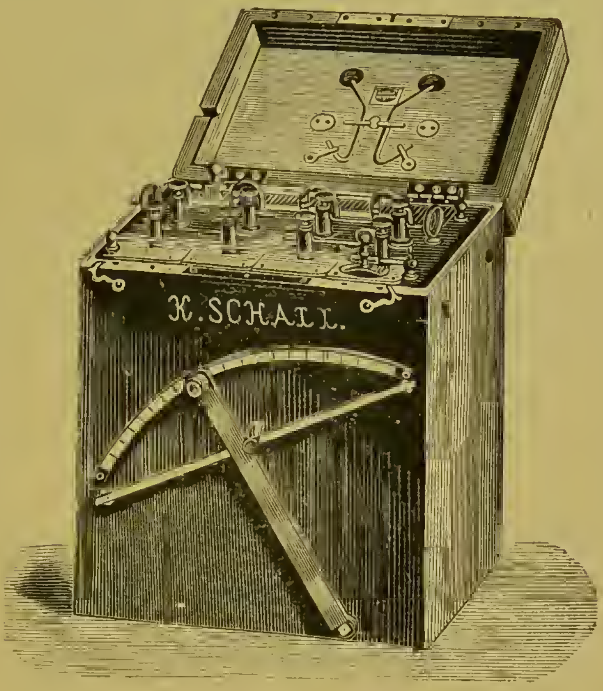


Fig. 46.

This battery is made up of eight carbon and four zinc plates; the latter are mixed together with some mercury, so that it is not necessary to amalgamate them.

The chemical exciting agent is contained in an ebonite vessel, which can be raised or lowered by means of a crank, and can be fixed at any height. A rheostat of wire of ten Ohm's resistance allows a very fine graduation of the current strength for lamps as well as for cautery purposes, and by means of two straight or two bent wires the cells may be connected parallel when required for cautery purposes, or in series if intended for electric light.

Mr. Schall informs me that one charge of the battery will last for several weeks, but this of course depends upon how frequently it is used. The wire carriers and handles are made of various shapes, but it requires a little practice to become familiar with their use. It is quite a vexed question as to how far the galvanic cautery is superior to the knife, but in all minor operations, electrolysis should be equal to, and in some cases superior, to galvano-cauterization.

Mr. Schall has now an excellent form of storage battery for surgical work, which is likely to come into extensive use; it has the advantage over the primary battery inasmuch as the accumulator gives an absolutely constant current during the specified period of discharge, and is always ready for use: it not only answers the purpose of cauterization, but is also useful for small glow lamps, induction coils, dental motors, &c.

The two sizes of accumulators for these purposes most commonly adopted and made in a portable form are a 4-cell battery of three plates in each and a 2-cell battery of seven plates in each.

The accumulators are refilled as required.

Static Electricity—*Electrization.*—This mode of applying electricity is convenient and effective. In the first place it can be applied without the electrodes coming into contact with the skin; in other words, there is no occasion for the patient to undress. It is largely used upon the continent, and I believe I am right in stating that M. Charcot thinks it useful and prescribes it in certain neurosal affections. I have used it extensively both in hospital and private practice. The greatest drawback to its becoming more general is due to the fact that the ordinary machines will not act well unless atmospheric influences are favourable, for the air must be dry and the friction maintained with regularity, by means of a small gas engine. I have been particularly struck with its effects in muscular atrophy, and it certainly has produced unquestionably good results when both faradization and galvanization have seemed to be useless.

These conclusions are borne out by the remarks of Dr. William J. Morton, in a paper read before the American Neurological Association, entitled "Notes on a year's progress in medical electro-therapeutics by statical electrization." Dr. Morton says that while conceding the comparative inconvenience of static machines he felt more confidence than formerly, even that statical electricity, as a curative form of treatment, was fully equal, if not superior, to galvanism and faradism. The diseases in which, in his opinion, static electricity was equal or superior to other forms of electricity were paralyses, where other forms of electricity would be advised, neuralgias in every form, spinal irritation, rheumatism in all its forms except the acute, and hysteria in all its manifestations. I must say that my experience is quite in agreement with that of Dr. Morton, and I cannot commend it too highly in muscular atrophies of protopathic origin, but I have no time to discuss the therapeutic effects of static electricity in this lecture. The machine which I have here is a modification of "Wimshurst's Influence Machine." If you sit upon this well insulated stool and take hold of the brass rod which is known as the prime conductor, the surface of your body will become charged with positive electricity, whilst the surrounding air is rendered negative. You are now in an electric bath; that is to say, the surface of your body is bathed in the electric fluid. I have here all kinds of electrodes of varying resisting power, we say some are bad and some good conductors. So long as the machine is in operation I can withdraw the electricity from your body in a dense or in a diffused form just according to the nature of the electrode which I employ.

The following illustrations demonstrate a new form of electric "influence" machine for medical purposes, designed by Professor Lewandowski, of Vienna.

Fig. 47 represents the machine; *Fig.* 48 the whole apparatus for franklinisation; and *Fig.* 49 the internal arrangement of the essential parts of the machine.

The two vertical iron supports, a a_1 and b b_1 (*Fig.* 47), are screwed to the four-legged wooden frame Ra Ra_1, their tops being joined together by the vulcanite rod a b. These two uprights support the axles e f, W_1 and W_2, which are parallel to each other. The axle e f is fixed, and made of steel. Upon the chief axle e f, there are two vulcanite collars, one of which is joined to the pulley r, and the other to the pulley r_1 (*Figs.* 47 and 49). In the middle of these two collars there are, on the chief axle, two hard-gum cylinders T (*Fig.* 47), one within the other; T T_1 (*Fig.* 49). The pulley r is connected with the internal cylinder T_1, whereas the pulley r_1 is connected to the external cylinder T so that the internal cylinder T_1 and the external one T can be rotated quite independently (*Fig.* 49).

The two lower axles W_1 W_2 (*Fig.* 47) each carry a large pulley, R R_1, and a toothed wheel. The large pulleys, R R_1 are respectively united by means of straps to the superior pulleys r r_1 (*Fig.* 47 and *Fig.* 48). The axle W_2 moreover carries the handle k (*Fig.* 47). This whole arrangement allows the two cylinders to be turned in the reverse direction when the handle is rotated only in one direction. The wooden frame carries besides two uprights, the lower parts of which are made of glass and the upper of metal; they terminate in the metallic knobs m n (*Fig.* 47 and *Fig.* 48). In the middle of these supports are two metallic knobs Sk Sk_1 (*Fig.* 47), each carrying a collecting comb in close proximity to the external cylinder. The fixed steel axle e f carries a vertical metal rod inside the cylinder. In the knobs m n (*Fig.* 47) the conductors A_1 A_2 can be moved to and fro in the horizontal direction. If the knobs of the conductors are brought near each other so as to come into contact when the handle is turned in any direction, it suffices to touch the surface of the external cylinder with a strip of hard caoutchouc which has been rubbed with cloth (for instance, with the coat) for exciting or charging the machine. This manifests itself by a whizzing sound. The strip of hard caoutchouc must be approached just in the middle of the two collecting combs Sk Sk$_1$ (*Fig*. 47).

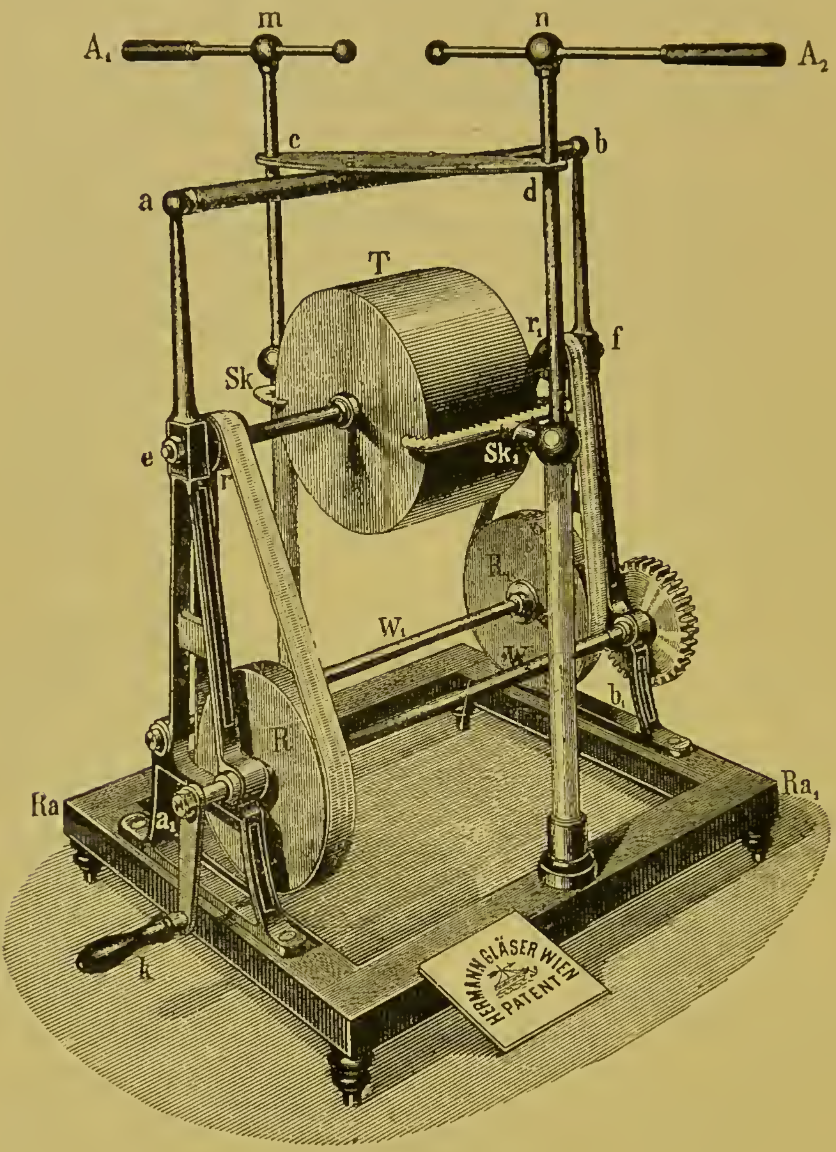


Fig. 47.

When the rotation is again interrupted, the charge of the cylinders with electricity lasts for several hours as the result of a single rotation. The advantage of this over all other machines of the kind consists in the very convenient and durable form of the electro-motors, that is, the cylindrical form; furthermore, in the choice of the material (hard gum), which is more durable than glass, as well as in the hermetical closure of the hard gum cylinders. Owing to the latter quality, the machine could be kept in any place, in dry as well as in moist air, and used at any time, without being damaged, as neither air nor dust could change the internal surface of the external cylinder and the two surfaces of the internal cylinder. The machine is moreover very portable, and not dear (75 florins, about £6). Other advantages are the long duration of the electricity once produced, even after the rotation of the handle has ceased; the possibility of rotating the latter in an inverse direction without discharging the machine; and the easy change of the poles.

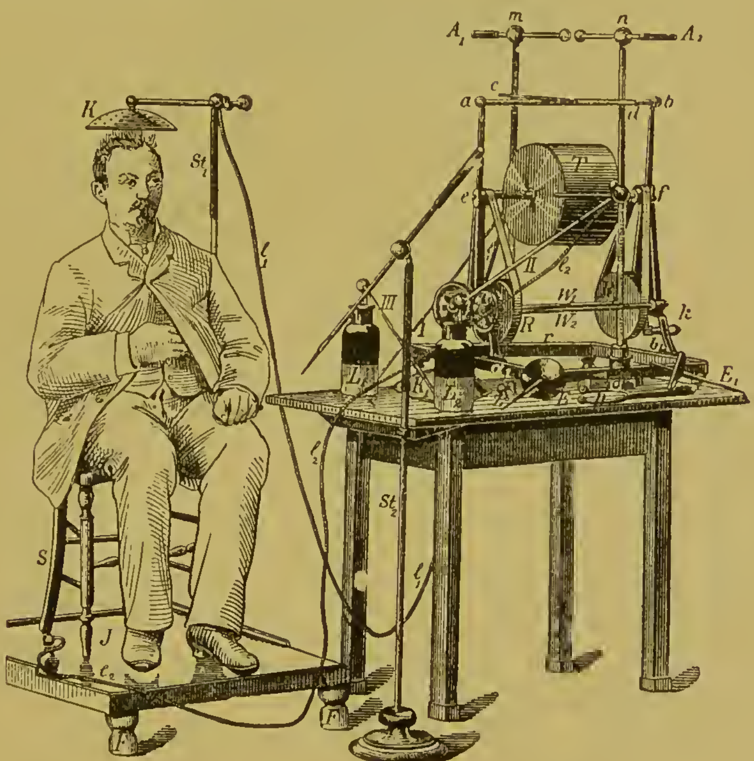


Fig. 48.

In *Fig.* 48 the rest of the apparatus necessary for franklinisation as devised by Professor Lewandowski is illustrated. It must first be remarked that when the machine is charged without the insertion of Leyden jars (L_1 L_2, *Fig.* 48), and the discharging rods are removed from each other, a few sparks appear between the knobs of the conductors. If, however, the

Leyden jars are inserted, quite powerful white sparks appear between the discharging rods. The rest of the apparatus is composed of two stands (St_1 St_2, *Fig.*48) for different electrodes, as, for instance, for the cap K (*Fig.* 48) for the electric head douche, which is fixed to a stand (St_2, *Fig.* 48), and is movable in all directions. The cap K is provided with spikes; the cap K_1 on the table (*Fig.* 48) is smooth. The apparatus also comprises the four-legged insulating stool J (*Fig.* 48), the legs being made of porcelain, for the chair S, where the patient is placed. The insulated cords l_1, l_2 (*Fig.* 48) unite the collecting combs of the machine with the insulated stool J and the electrodes. E_1 E_2 are hand electrodes, O an ear electrode, D a discharging rod for the discharge of the bottles (*Fig.* 48).

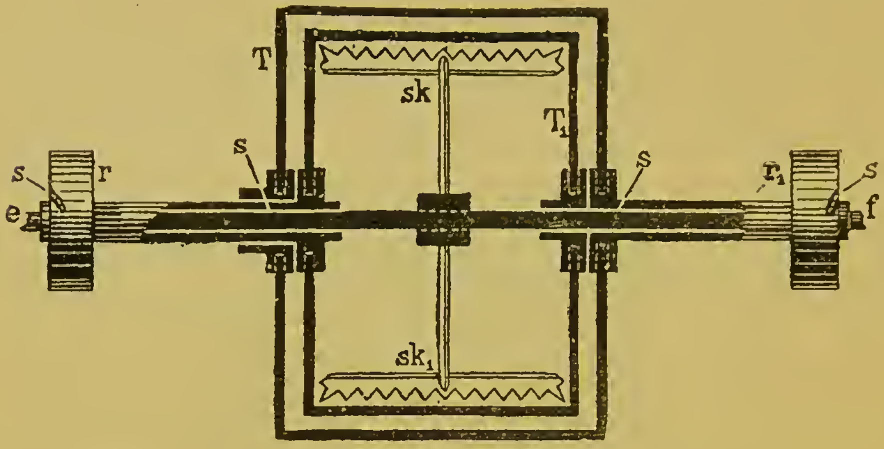


Fig. 49.

As to the methods of franklinisation, they comprise *a*, the electrical charge; *b*, the electrical wind; *c*, the discharge of sparks. These three methods in the order here enumerated also represent the three degrees of intensity of franklinisation, the charge representing the mildest, and the sparks the most intense method. The charge is thus given. The patient is placed on the insulated stool J (*Fig.* 48) and unites the bottles to the positive or negative pole of the machine, whereas the second pole is conducted downwards into the earth.

The electrical wind, which is also called the electrical air bath, and also, though wrongly, general franklinisation, is produced in the following way:—The patient is placed on the stool, which is as before united to one of the poles of the machine; the second pole, however, is not conducted into the earth, but is brought into contact with an electrode terminating in a point which can be approximated to the corresponding part of the patient by means of the hand or by means of the stand St_2 (*Fig.* 48).

In general, the last two methods in Professor Lewandowski's experience had the same effects as induction currents, the only advantage they presented being, *that the patient might be electrified through his clothes, that he need not undress,* a point of considerable importance in female patients. On the other hand, the three methods had also peculiar effects, which could neither be obtained by the galvanic currents nor by the induction currents.

Lecture XV.

ELECTRO-THERAPEUTICS.

Electrodes, Varieties of, Application of—Density of current—Difference of Potential of electrodes—Size, position and nature of electrodes—Strength of current—Diffusion of currents—Place of poles—Relative size of Electrodes according to effect required—Selection of current—Faradic, Galvanic, Combined current—Object of Electricity—Action of Faradic and Galvanic currents—Use of the terms stabile, labile, anode, kathode, unipolar, bipolar—Indications for the disuse of faradization in Nerve degeneration—Dosage of electricity in reference to Strength of current and Time—Polarity and Direction of current—Ascending and descending currents—Action of Kathode and Anode--Electrotonus—Electro-diagnosis—Pflüger's Law—Analectrotonus—Katalectrotonus—Creation of polarity—Polar zone—Peripolar zone—Density of current—Derived and Diffused currents—Unipolar influence converted into Bipolar—Katalectrotonus or increased excitability—Analectrotonus or diminished excitability—Contraction in reference to Opening and Closing the current—KCC, ACC, KOC, AOC—Experiment upon Patient demonstrating electrotonus—Reaction of Degeneration in ant. polio-myelitis—Reaction of muscles in Brain disease—In Spinal disease—Increased muscular excitability—Diminished muscular excitability—Motor points of muscle—Polarity considered from its Therapeutical aspect—Torticollis, treatment of—Nutritional effect of kathode Voltaic alternatives—Labile galvanization—Faradization, Duchenne's theory of the Two currents—Althau's opinion of Skin faradization—Galvano-faradization—Electrolysis, Apostoli's method—Sir Spencer Wells' electrolytic treatment of Uterine disease—Electrolysis of Nævi, of Goitre, of Aneurisms, of Strictures—Ovarian pain—Galvano-faradization for muscles and joints, in Locomotor ataxy—Neuralgia—Electrization of Brain and Spinal cord—Chorea—Epilepsy—Incontinence of urine—Writer's cramp—Facial paralysis—Lead paralysis.

In my last lecture I endeavoured to give you some idea of an electric current, its agency for the transmission of power, how for medical purposes it was best generated, its capacity through its electro-motive force in producing physical, chemical, physiological and mechanical effects, the strength of the current varying according to the potential of the cells in the battery, the resistance of the human body to the current, the value of using a galvanometer in circuit to measure its strength, and so on. To-day we have to consider practically and as concisely as possible the effect of both the *galvanic* and *faradic* currents upon the human body as a whole and upon certain constituent parts, and I am anxious that my remarks shall refer to the practical application of electricity and its therapeutic influence, rather than to its physiological effects. Of course, therapy and physiology can scarcely be disassociated, but everything which I have to say shall have a practical rather than a scientific potentiality. *No one should apply the electric current to the human body unless he possesses a knowledge of its power, and also a knowledge of the capacity of resistance which certain parts of the body have over other parts.*

Electrodes.—We apply electricity to the human body, as you know, by means of electrodes; you have various kinds of electrodes before you, in fact, one might say their name is legion. This fine needle which I have in my hand is an electrode, and so is the large sponge with a piece of metal attached to it; here we have a spinal sponge electrode, and here is an electrode for the liver; this large flat electrode for the feet is a piece of perforated zinc covered with three or four layers of flannel, and this foot-bath, to be used with plain or salt water, forms an electrode; you know I also make my hand an electrode; the most common form of electrode is this cup, made of copper or vulcanite, into which a sponge is inserted; this is, perhaps, the most useful form of electrode when you want *labile* applications of electricity to extend over large surfaces; it is well to remove the sponges for cleanliness after each application and keep them in a weak solution of ammonia or common salt. The sponge electrode I now show you has many good points (the drawing is about one fourth its ordinary size), the chief feature of it is that the sponge is firmly fixed, and for general faradization this is important; it was invented by Dr. Herschell (*Fig.* 50).

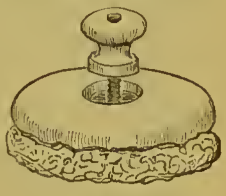


Fig. 50.

Equally as useful as the sponges are the carbon discs: they consist of carbon enclosed in a cover of flannel or wash leather; the advantage is that their resistance is less variable than that of sponge and a more definite pressure can be exercised and maintained without experiencing any discomfort from an overflow of water, it is easy also to apply a fresh piece of chamois leather at any or every application (*Fig.* 51).

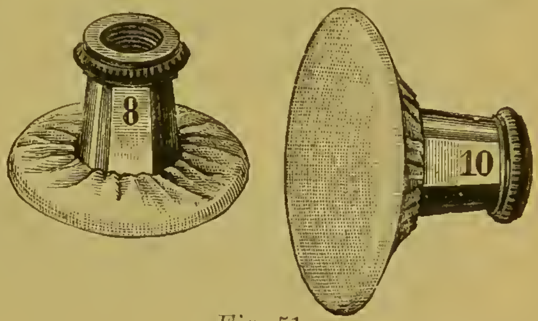


Fig. 51.

The plate electrode I now show you is very useful and inexpensive, it is simply a piece of sheet lead, *and can be made of any size most convenient*, it is pliable and fits accurately to the skin, and it can be easily slipped under the patient's dress, and kept in position by the pressure of the clothes; you see the lead is covered with flannel or chamois leather. You will remember that these electrodes must be made *thoroughly wet* either with plain or salt and water, and you know that by so doing you lessen resistance and aid conduction. It is necessary that you have a series of these electrodes of various sizes for the sake of convenience. Prof. Erb speaks of electrodes of varying sizes under the names of fine, small, medium, large, and very large, these sizes are upon the table. This may be called a fine electrode, its tip comes almost to a point, it is serviceable for *electro-diagnosis*, in the application of the current to *motor points*, to small nerves and muscles. You will soon find out by practice the kind and size of electrode which is required to do certain forms of work ; your own common sense will tell you if you have to apply electricity ; to a large nerve or a mass of muscle you must use an electrode of proportionate size.

In passing, let me draw your attention to special forms of electrodes for the application of the current to special parts. This is for the larynx, this for the stomach, this for the uterus, this for the bladder, this for the rectum. These rectum electrodes were introduced a short time since by Mr. Benton, and he tells me that he finds them very useful in the treatment of stricture of the rectum (*Fig.* 52). Their application is a very easy matter. When the stricture is of a fibrous annular character the negative pole must be used with a current strength of from six to ten milliampères, but if the stricture is spasmodic the faradic does as well or better than the galvanic.

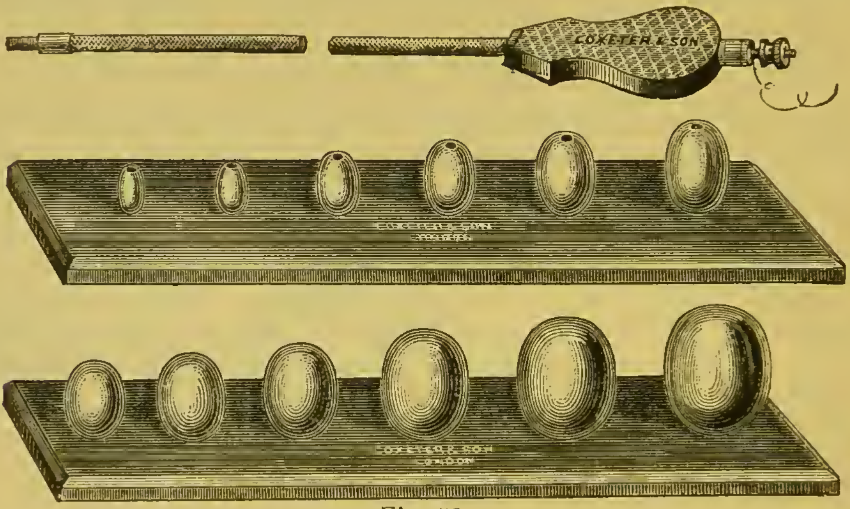


Fig. 52.

Fig. 53 is called Gartner's belt electrode. You see it has a spring and cylinder by which it can be fixed upon any part of the body.

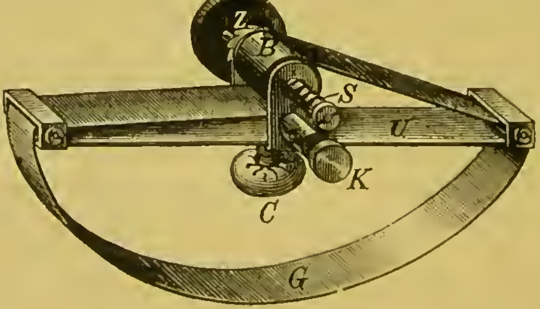


Fig. 53

Fig. 54 is called a brush electrode. It is made of various sizes, and comes under the class of *dry electrodes*, they are used for *cutaneous faradization*. It is usually made of nickelized copper wire, and resembles an ordinary painting brush; sometimes it is made of the size of a clothes brush, in fact it can be made of any size.

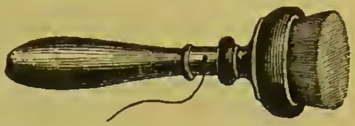


Fig. 54.

These instruments are for the treatment of fibroid tumours of the uterus, according to Dr. Apostoli's method, of which I shall have something to say directly (*Fig.* 55).

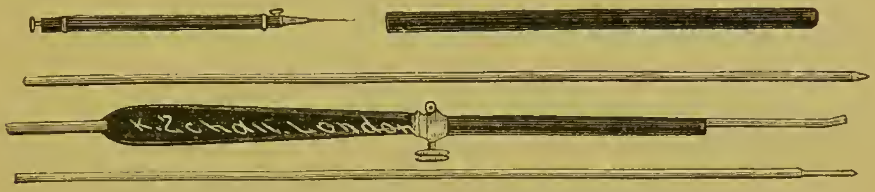


Fig. 55.

Fig. 56 is a needle holder for electrolysis, for the reception of different sized steel or platinum needles, and these are needles with flat platinum points and with shafts insulated by ebonite. They are also made blunt pointed and can be used for stenosis of the lachrymal duct.

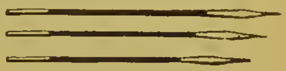


Fig. 56.

These are other electrodes used by Dr. Apostoli. *Fig.* 57 is a double concentric disc electrode; *Fig.* 58 is a double conic disc electrode; *Fig.* 59 is a vaginal electrode, and *Fig.* 60 is an electrode for the urethra and uterus. The electrodes *Figs.* 57—60 are specially for localizing the effect of galvanic and faradic currents.

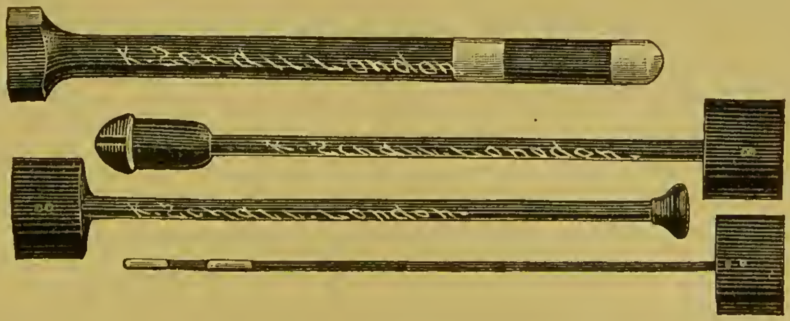


Fig. 59.

Fig. 58.

Fig. 57.

Fig. 60.

The electrodes here figured are arranged for making and breaking the current.

No. 1, Simple electrode holder (*Fig.* 61). No. 2, Electrode holder with current interrupter (*Fig.* 62). No. 3, Electrode holder with contact maker (*Fig.* 63).

The electrode which I now show you is admirably adapted for electrical diagnosis, it has been arranged by Dr. Hughes Bennett; he calls it "the combined handle electrode," and it certainly possesses many advantages. By means of this instrument the operator's attention can be given to his operating without constant reference to the element board; it contains all the necessary elements for scientific clinical investigation, namely, first, a current graduator, second, a current interrupter, and a means of opening and closing it, and third, a current reverser. It may be attached to either the faradic or galvanic currents. When in the hand of the operator all the accessories can be put in action by the movement of one finger, thus greatly facilitating the delicate manipulations of the investigator, and obviating the necessity of dividing his attention and altering his position, as he is compelled to do when working with an element board."

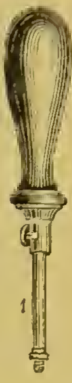


Fig. 61

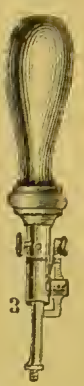


Fig. 63

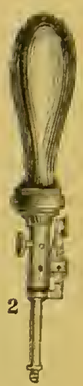


Fig. 62

So much for electrodes. We next have to consider the rational *application* of electrodes, in order to produce definite results, and we must not forget that "the action of a given current is proportionate to its density," and the *density* of a current may be described as the quantity of electricity flowing through a *unit of sectional area* in a *unit of time*, this follows the laws of *diffusion* and *resistance*, which are quite as applicable to air and water as to electricity. I now apply these medium electrodes to the arm of this patient, and I know that the current is *most* dense in the wire, *less* dense in the electrodes, and *least* dense in the arm between the electrodes.

We say that there must be a difference of potential between the elements of the battery in order that the electric current may be generated, and we also say that in order for a current to flow from one point to another there must be a difference of potential between those two points, if we want *intensity* of action at any *given* point. Hence the different parts of a conductor through which a current flows must be at different potentials. The current of electricity which I now cause to flow through this arm must diminish or increase according to the nature and size of the electrodes which I employ; this is self-evident. You see by the galvanometer that I have a current of five milliampère strength, and I have attached to the terminals two *fine* electrodes; by making and breaking the current, the muscles respond actively. I now take two medium size electrodes and use the same strength of current, but the muscles respond only feebly, showing that the density of the current is inversely proportional to the area of the electrodes, therefore the *size*, *position*, and *nature* of the electrodes are of great importance in the application of the electric current. It is a question of *intensity* and *diffusion*. In applying electricity to the human body, in order to be definite, our strength of current should be *known* and *absolute*, the electrodes should be of *uniform* size and shape, and so adapted to the parts that a certain *density* of current may *diffuse* itself amongst the tissues; therefore, if we wish to concentrate the effect of one pole upon a small superficial structure, such as a nerve or motor point, the electrode applied over it must be small, and the other electrode must, of course, according to this mode of reasoning, be large, and may be applied to any distant part of the body, the force of this will be more evident when speaking of *electrolysis*. You must not, if you please, imagine for one moment that the larger the electrode the more electricity is being conveyed to the part to which it is applied, you have simply the same force acting, but being diffused over a larger area.

By way of example, I take these two large sponge electrodes of Dr. Herschell's, they are of the same size; you see by the galvanometer that my current is still of the strength of five milliampère. I know that my battery is working at so many volts (units of electro-motive force), but this we do not trouble about for our present demonstration. I place one of the electrodes upon the sternum and the other upon the opposite vertebræ of my patient, now by the common ordinary law of diffusion and direction I know that the two currents in this respect, positive and negative, are of the same density (they are, however, potentially different), but the waves of diffusion, just as the waves of water upon the sea shore, lose their intensity until physiologically they become almost inactive, still they are *continuous* and *operative*. In the human body we have to deal with a variety of structures, it is difficult to estimate its resistance, as a whole, in the same way that we would an elementary body; we know little more of internal polarization than we do of vital force, the whole thing is at the present time hypothetical. Currents at their make and break, *anodal* and *kathodal*, produce certain effects, physical, psychical, chemical, and vital, upon structures immediate and upon structures remote, according to the density of the current by which they are influenced.

SELECTION OF CURRENT.—We apply currents of electricity to the human body known as *galvanic* and *faradic*; we may use these currents *singly* or *combined*, but we must remember that their effects are distinctly different, so that it is a matter of no small importance for us to consider when we are determining the kind of current which we ought to employ. There is a prevalent idea which, to a certain extent, is justifiable, that the faradic or induced current acts more directly upon nerve, and that the galvanic current acts more especially upon muscular tissue. Again, some people apparently entertain the idea that it is unimportant which current is used, so long as the muscles are brought into a state of violent activity. I hope we shall see directly that these ideas are wrong. The object of electricity is to *excite* and *stimulate* the tissues. To produce muscular contraction is to aid the muscle to perform a normal function, and we know that due performance of function is essential in any organ to maintain its normal standard of vitality; *faradization* does this rather by its action upon the nerve than by any power which it exercises upon the muscular tissue. On the other hand, the galvanic current reaches the nerve through the muscle, molecule by molecule it influences the metabolism of the muscle quite independent of the induction of any contractile agency, so that we say the galvanic current is specially concerned in nutritional changes. The most that the *faradic* current can do is to stimulate a nerve into activity by vibration and percussion, and if by so doing it restores function, it unquestionably aids nutrition; there are many other points to be taken into account, and we shall, I hope, reflect upon them as we proceed.

We have just seen that electrodes are used as means to apply the current to the body. When the two electrodes are stationary the application is called *stabile*, when one or both are moved about it is called *labile;* the electrode carrying the positive current is called the *anode*, whilst the electrode carrying the negative current is called the *kathode;* the current may be applied by fixing one electrode to a determinate part of the body, whilst the other is applied to an indifferent part; this is called the *unipolar* method; or both poles may be brought to bear upon a single muscle; this is designated the *bipolar* method. The terms *ascending* and *descending* are sometimes spoken of in referring to currents.

In nerve degeneration there is a stage when the induced current fails to meet with any response, and this is called the reaction of degeneration; but the galvanic current will bring about muscular contraction. There is also a stage of degeneration prior to this, when the nerve responds feebly to the faradic current and readily, although irritably, to a weak galvanic current; now to use powerful faradization to a nerve in this condition is unwarrantable and unjustifiable, although the application of a weak galvanic current with slow alternatives may be exceedingly useful. Let me take a case of sciatica, rather than one of anterior polio-myelitis; in the first stages of sciatica the molecular activity of the nerve is merely deranged, but should the condition become inveterate and attended with myotatic irritability, we are naturally led to conclude that some degeneration has commenced in the nerve. In the former condition the faradic current is superior in its effects to the galvanic, but the use of faradization in the latter is to be condemned. I have seen the function of a nerve when in a state of degeneration hopelessly ruined by faradization, when a cure might have resulted by means of a galvanic current with slow alternatives. If you have any doubt about which current to employ, especially where there is a possibility of nerve degeneration, choose the galvanic, use it weak, continue it for ten or fifteen minutes, and alternately slowly once in thirty seconds.

If, on the other hand, you merely want the physiological effects or influence of an electric current to stimulate an inhibitory state of certain nerves or nerve centres, you can use faradization or the current from a static machine.

Dosage.—As I have said before, in using electricity you must know what you want to do and how best to do it; do not think that because a muscle is weakened that you are going to strengthen it by pouring electricity into it: remember this, the weaker the muscle or nerve the weaker (as a rule) must be the current of electricity employed: as the muscle or nerve grows in strength so you may increase the strength of the current, therefore in the administration of electricity you have at least three things to consider, namely, the *strength of the current, the nature and size of the electrodes*, and the *time* during which the current is allowed to flow. With regard to the strength of the current, in my own practice I never use strong currents, preferring a weak current to extend in its administration over a lengthened period of time; of course if this mode be adopted it is necessary to maintain the strength of the current during its flow, and in order to do this you must have a galvanometer in circuit, and ensure the moisture of the electrodes: do not misunderstand me, I am speaking now of applying electricity in a general way, knowledge and experience are very safe guides in all questions of this kind. In reference to *time*, I think five, ten, or, at the outside, fifteen minutes quite long enough for a single application; we must not forget that certain parts of the body are much more sensitive to the current than other parts—the trunk less than the head and neck; a current of strength borne comfortably by the extremities would be intolerable when applied to the eye or forehead, so you must please take all these things into consideration; stimulating muscles and nerves by electrical agency is like exciting the brain by the influence of alcohol, and the former should be regulated by dosage in the same way as the latter, tonicity and depression are inversely proportionate to the quantity administered and the duration of time in administration.

Polarity and Direction of Current.—A great deal is often written concerning the right application of the negative and positive poles, and of *ascending* and *descending* currents : I am somewhat sceptical concerning the soundness of these views in the *purely* therapeutical sense, although much might be said in favour of polarity.

Currents are said to have a *descending* or *ascending* direction according as they flow with or against the natural volitional impulse in motor nerves. Dr. de Watteville dissents from this view for the following reasons ; "1st, That in physiological experiments on human, as well as on frogs' nerves, all the phenomena observed are best explained on the theory of polar influences only ; 2nd, That it is impossible to send a current of any density in a given direction through a moderately long piece of embedded nerve; 3rd, That catalytical effects are independent of the direction ; 4th, That the theoretical claims set up in favour of specific indications for the use of ascending or descending currents in the treatment of various disorders is not justified by experience."

We know in reference to the galvanic current that the action of the *kathode* is *catalytic*, *exciting* and *destructive*, whilst the *anode* is *anodyne* and sedative, therefore an arrangement of poles may be credited with some advantage, and it cannot be denied that from the physiological point of view it has a rational and definite bearing. In the consideration of this question I take the opportunity of reminding you of variations produced in nerves (*electrotonus*) by the two currents, *positive* and *negative*, respectively, and not only by the currents themselves, but also upon their being *made* and *broken ;* but before I show you this experimentally let me draw your attention to certain terms which are well known in electrodiagnosis. We admit, by way of preface, following the classical researches of Pflüger, that the passage of a galvanic current through a nerve alters its condition and throws it into a state of *electrotonus*.

When a *single* current is made to enter a nerve through the tissues a difference of *polarity* is created, the current as it enters is *most dense*, and here it is known as the *polar zone*. When it becomes extended, weakened, and diffused, the zone of extreme diffusion is known as the *peri-polar zone*. I take this long glass and fill it with water, and upon its surface I drop, very gently, some tincture of iodine ; now you see as the iodine diffuses itself through the water, currents are created, some seen and some unseen, arising from the formation of different densities in the fluid. At the point of prime contact of the iodine with the water, let us say the currents are most dense, and we will call this the *polar zone;* but as the colour given to the water extends, the greater its extension the less do we find the intensity of colour, that is its minimum of density, therefore this I choose to call the *peri-polar zone.* I admit that it is simply diagrammatic, but it shows us for practical purposes, how, when the human nerve is placed under *unipolar* influence of the electric current, the latter diffuses itself in the surrounding tissues and brings about a difference of density in the current itself, and we know that the human nerve is surrounded by textures and fluids which are better conductors than the nerve, so that derived and diffused currents are immediately established. It does not matter whether the current is *anodic* or *kathodic,* if it be *anodic* at the point of entrance its limits of diffusion *(peri-polar zone)* are *kathodic,* and if at its point of entrance the current is *kathodic* its limits of diffusion are *anodic.* So directly we place the electrode upon the nerve we create a *unipolar* influence into that of *bipolarity.* With regard to the following, then, let us be clear, remembering that contractions of muscle follow upon opening and closing the current.

At the point and time of application to a nerve of the *negative pole (kathode)* we *make* or *close* the current the excitability of the nerve is *increased* (KATELECTROTONUS).

At the point of application of the *positive pole (anode)* the excitability of the nerve is *diminished* (ANELECTROTONUS).

The contraction produced by *making,* or, as it is called, *closing* the *kathodic* current *(katelectrotonus),* is represented by the letters KCC (kathodal closure contraction). The contraction produced by *making or closing* the *anodic* current *(anelectrotonus)* is represented by the letters AAC (anodal closure contraction) whereas:

The contraction produced by *opening* the *kathodic* current is represented by the letters KOC (kathodal opening contraction). The contraction produced by *opening* the *anodic* current is represented by the letters AOC (anodal opening contraction).

Let me make CONTRACTION upon *opening* and *closing* the circuit in reference to *polarity* evident to you by actual experiment. This Stöhrer's battery has on the top of it a sledge collector and a current reverser, by moving this handle I can not only open or close the current flow, but I can alter or reverse the polarity, making the current either kathodic or anodic. My battery is now in action, but the circuit is open, the handle is vertical; I now place, quite indifferently, one electrode at the nape of the neck and the other upon the ulnar nerve at the lower third of the inner part of the forearm, please watch attentively the contractions which will arise, they vary in time and differ in degree according to the polarity of the current; the electrodes are well wetted, and my galvanometer denotes five milliampère current strength. When I move the handle this way the current is negative, and this way it is positive; now I want you to observe the openings and closings in relative order: 1st, I shall establish kathodal closure contraction (KCC); 2nd, Anodal closure contraction (ACC); 3rd, Anodal opening contraction (AOC); 4th, Kathodal opening contraction (KOC). From the contractions which I have just produced I think you must come to the following conclusions which I have noted upon this board, namely:—

Kathodal closure contraction (KCC) comes first.
Anodal closure contraction (ACC) comes next.
Anodal opening contraction (AOC) comes next.
Kathodal opening contraction (KOC) comes last.

I want you to remember what you have just seen, that these contractions varied in *time* and *degree*; 1st, the KCC was very active; 2nd, the ACC was active; 3rd, the AOC was less active and followed rapidly upon ACC; 4th, the KOC was scarcely visible. Let us repeat the experiment with a current strength of three milliampère, we now find activity with KCC, slight with ACC, very slight with AOC, and absent with KOC, therefore it is clear that the current must be relatively very strong to excite contraction with KOC, compared to that which is necessary to excite contraction with KCC; the following list will show you the effect of variations of current *necessary* to bring about contractions.

1, Weak current (KCC).
2, Medium current (ACC, AOC).
3, Stronger current (KOC).

It is absolutely necessary that we consider these contractions in reference to *time* and strength in the degeneration and regeneration of nerves and muscle in anterior polio-myelitis. (For example, see Lecture V.)

The reaction in both nerve and muscle is *qualitative* and *quantitative;* when there are changes in normal conditions they are called *degenerative,* and the reactions of these structures to the galvanic and faradic currents are said to denote "*reactions of degeneration,*" when the muscular contractions to the *kathodic* and *anodic make* and *break* are altered and fail in normal strength to the *galvanic* current, they are called "serial alterations," when the mode or course of the contractions are altered, they are called "model alterations."

Let us consider for a moment diseases of those parts of the nervous and muscular apparatus in which the re-actions are usually found to be normal.

1. ALL PARALYSES of cerebral origin or *hysteria* are not accompanied by change of *normal electrical reaction*, so long, of course, as no secondary changes have arisen in the spinal cord. Muscles and nerves which are hopelessly paralyzed may still respond normally to either current.

2. DISEASES such as *lateral sclerosis, locomotor ataxy,* and *disseminated sclerosis,* so long as the anterior horns of the *grey matter* remain intact, respond normally to the electrical excitation.

3. SPINAL LESIONS will engender the RD *only* in those nerves and muscles which are directly associated with the lesion wherever it may be. For instance, degenerative changes will exist in the muscles in proportion to the seat and extent of the lesion in the anterior horns of the grey matter. On the other hand, when the *trunk* of a nerve is diseased the degenerative processes extend over and are limited to all the muscles supplied by that nerve.

The electrical excitability of a nerve and its power of *conduction* are generally lost together, but *regenerated* nerve fibres may regain *conducting* power before they can be excited by electricity, and a muscle *may* continue to show the reaction of degeneration when it is susceptible to a voluntary stimulus sent from the brain.

Increased excitability of muscles to galvanic excitation is frequently met with in the early stages of degenerative reaction, "myotatic irritability." I have often found increased faradic muscular irritability in the limb *opposed* to that which has been the seat of paralysis from *polio-myelitis.*

Diminished excitability, independent of the ordinary forms of degenerative reaction, may occur in many of the stages of old-standing chronic disease of both the nervous and muscular systems, and leads us to the conclusion that hysterical and cerebral disturbances and shamming do not exist.

MOTOR POINTS OF MUSCLE.—If you examine these drawings, which have been enlarged from woodcuts (woodcuts to be found at the end of the book), you will see markings. Each mark indicates the motor points of certain muscles, or that part of the muscle at which *the nerve enters.* Duchenne called these the points of election. Ziemmsen has more recently investigated this subject with care. When the electrode from a faradic battery is placed over the points as indicated, it is quite clear that every fibre of the muscle is brought into a state of activity, but if the electrode be applied indifferently, only certain groups of fibres will be influenced, some nerves going to muscles take a superficial course before they enter the muscular substance, and are readily stimulated by the current, and thus groups of muscles are brought into action. Such nerves are, for example, the median, the ulnar, the radial, the crural, the perineal and the tibial. Intra-muscular faradization is best made by placing one electrode at the back of the neck and applying a large sponge electrode to the body of the muscle; one advantage of this is that the current has far less effect upon the sentient nerves, and consequently causes less pain than if a small conductor be used.

An electrical stimulus applied to a healthy muscle should call forth a well-defined, short-lived jerk, instead of a slow, lazy, indifferent contraction, which is indicative of some intrinsic change. There are several extrinsic factors to be taken into consideration in the production of muscular contraction. First, strength of current; 2nd, the size of the existing electrode; 3rd, the relative position of the exciting electrode, and the motor point of the muscle, and also to the presence or absence of motor nerve filaments. In cases of partial muscular degeneration the *maximal* contractions are usually diminished whilst the *minimal* may be obtained with low current strengths. In testing the excitability or contractibility of a muscle, that is, its electrical reaction, it is necessary to compare it with a corresponding spot of the same muscle on the opposite side of the body.

Polarity, *considered from its therapeutical aspect.*—I cannot divest myself of the conclusion that the unipolar method of treatment has great advantages. The energy and capacity for action which distinguishes so markedly the current at the negative pole, ought to give to it decided and marked results over the positive pole. If the two poles (bipolar method) are placed upon the part which is diseased, the influence of electrotonus fails to have an existence; on the other hand, it is possible that the catalytic influence of the negative pole may be increased, but in the ordinary process of galvanization this is scarcely borne out in practice. It is possible, and to me it seems most probable, that by using the negative pole over the diseased part, you bring about both electrotonic and catalytic effects. However, the general rule is that the *indifferent* pole be placed upon any part of the body, whilst the executive pole be placed upon the seat of the disease. If we want to obtain a soothing anodyne or even a depressing effect in a painful or spasmodic nerve, such as we find, for instance, in neuralgia and torticollis, we use the positive pole so as to produce diminished excitability in the nerve (anelectrotonus). If, on the other hand, we want to stimulate a nerve into increased activity, to permeate it with nutritional influence, to increase its metabolic energy, we use the negative pole to produce these results (katelectrotonus). Whatever theories may exist relative to polar arrangements (bipolar or unipolar) you know my practice is to adopt the unipolar method. I am not such a firm believer in the anodyne influence of the anelectrotonic pole, but I am a very staunch believer in the good results which I obtain from katelectrotonic agency. You know the case of torticollis now under treatment. She was faradized in hospital for six weeks without the slightest benefit, and for the past month I have been applying the unipolar galvanic current with rather active voltaic alternatives with the most excellent results. I have occasionally employed galvano-faradization, which, in my opinion, has hastened the cure. The anode, if you remember, was placed at the nape of the neck, whilst the kathode (sponge) was applied to the spasmodic muscles. The nutritional effect produced by either pole depends mainly upon the strength of current. This is usually ascribed to the positive pole, but the catalytical agency of the negative pole is distinctly and unquestionably nutritional, if the current is of moderate strength; if, however, it is too strong and maintained for too great a length of time, it is not only exciting, but it is degenerating. The more one thinks of polar action, I mean, of course, in the application of electricity to nerve and muscle as a therapeutic agent, the more one feels convinced that success can only be dependent upon a thorough understanding, not only of the right application of the poles, but also to the precise strength of current which is called into action. The little which I know of electricity is entirely the result of a fair amount of practice, combined with careful and painstaking observation both of cause and effect. In applying the galvanic current (stabile) for any length of time, say twenty or thirty minutes, always keep your galvanometer in circuit and do not use a current strength of more than ten milliampères, and let the negative pole have a fair area as well as rheostatic influence, otherwise you may find the epidermis of a very significant black colour upon its removal, which may be somewhat alarming to the patient and unpleasant for the operator.

I have spoken to you before of *current reversals* or *voltaic alternatives*. I believe thoroughly in exercising the alternative influence of both poles, but I prefer the reversals to be made slowly and infrequently.

Galvanisation means, then, in order to be explanatory, the application of electricity to the human body to bring about certain results according to the nature and strength of current used, taking polarity into consideration. We have seen that its effects may be sedative, anodyne, alterative, catalytic, exciting and nutritive. It may be applied according to the *bipolar method*, having both poles near each other upon the diseased part, or it may be applied according to the unipolar method, placing one of the poles at some indifferent part of the body. Its application may be stabile or stationary, labile or mobile, extending by movement of the electrode over a given area; and that the current is continuous in its action, but contractions of muscle result from opening and closing the current, and shocks are experienced, sometimes of a disagreeable character, if the current be too strong; therefore to avoid these shocks the current at the commencement and at the end of the application must be *gradually made and broken*. From what I have previously said you must see the importance of this. There are many valuable hints which I should like to give you of incalculable importance in applying galvanism to the head and the sympathetics in the neck, but I must leave a full consideration of these for another lecture; but before applying the current to these regions, which you must do after the labile method, by means of a fairly large sponge electrode, you will hold one electrode in your hand and apply the sponge to your own temple, and thus have satisfactory evidence of the strength of the current before administering it to your patient. The labile method of applying the galvanic current is not so popular as the stabile with alternatives, nevertheless, it has advantages, which may be worth a moment's consideration. You take this flat electrode, fairly well moistened, and place it at the nape of the neck or a little lower, you then take a good sized sponge electrode, moistened with water, or, as I generally use it, salt and water, the sponge must then be passed over the limb with a fair amount of pressure, the surface of the sponge must be kept in contact with the skin; it must be evident to you that any breach of contact will produce muscular contraction and influence polarity: if such is required, this is one means of bringing it about.

Faradization.—You are aware that every induction apparatus is capable of giving rise to two currents, namely, the primary, or extra current of the thick wire, and the secondary current of the fine wire. There are some physicians who disbelieve in the physiological difference in action of these two currents, but Duchenne's testimony is to the effect that there is a decided difference. He says that the primary current acts chiefly upon the contractile power of the muscles, whilst the latter has more effect upon the sentient nerves. Duchenne has referred this difference of action to a special elective power in each of these currents, but Althau agrees with Berguerel that the difference in the physiological effects of the two currents is chiefly due to the difference which exists in their tension, but he does not believe that this difference of tension is quite explanatory, for it should be recollected that the primary or extra current always moves in the same direction, and has, therefore, feeble electrolytic effects, while the secondary current which alternately moves in different directions has the electrolytic effect of one intermittence neutralised by that of the next.

FARADIZATION OF THE SKIN.—You are so constantly faradizing the skin that I need scarcely say anything to you about it, but there are one or two points to be taken into consideration in carrying out thoroughly this procedure, and its effects are usually so agreeable that I might just call your attention to them. You can, of course, use any electrode you like, or wire brush, but my mode is to use the hand ; in the first place, the skin of your patient must be free from moisture, if not, it must be made so by the use of starch powder ; in the second place, your hand must be dry ; in the third place, the electrodes, one of which is applied to the body of your patient and the other to your own body, must be *not* too freely moistened.

Faradization by fine metallic wire brushes fixed on insulating handles is not an uncommon method, but is sometimes exceedingly painful. The neck and trunk are more sensitive than the extremities, the cervical and lumbar region more than the other parts of the back, the inner and anterior surface of the extremities more than the external. The wire brush application is more useful in cases of anæsthesia and in hysterical paralysis. In skin faradization by the direct mode the conductors must be dry, or otherwise the electric current will traverse it and enter the muscles. I should advise you in applying the faradic current to the head always to use the hand as the conductor. The lively crepitation which you hear is due to the passage of sparks between the skin and electrode. The size of the electrodes should be small for localized faradization of single muscles, motor points and nerve trunks. I always use large sponge electrodes for exciting large muscles or groups of muscles.

GALVANO-FARADIZATION.—I believe Dr. de Watteville claims the merit of having introduced this method of treatment into electrotherapeutics. I have, like many other physicians, used it for many years, and I cannot speak too highly in its praise. Many cases of paralysis and spasm of muscle and brain and nerve exhaustion and neuralgia have yielded to its effects in the most satisfactory manner, when single currents have been of no avail. Many machines are now arranged by connecting the wires so that the combined current can be applied just as easily as a single current. The combination consists in uniting the secondary induction coil and the galvanic battery in one circuit, by connecting with a wire the negative pole of the one with the positive pole of the other, attaching the electrodes to the two extreme poles and sending both currents together through the body.

I find this combined form of electricity particularly useful in cases of nerve exhaustion and general prostration, but I have yet to learn its precise mode of action; it may be that the restoring, strengthening, and tonic effect of the galvanic current overcomes any debilitating influence which might, and sometimes does, follow faradization. A gentleman who frequently comes to me for what he calls his pick-me-up, says it acts upon him like champagne without its subsequent depressing tendency. I find it necessary to graduate the combination. Some cases require galvanism plus faradism and others faradism plus galvanism. In spasm and painful muscular affections its utility is unquestionable, and the same holds good for a paralyzed muscle with trophic changes (protopathic and deuteropathic). In faradizing a muscle we cause artificial movements to prevent the degeneration which would otherwise ensue from inaction, and we also, by means of the galvanic current, stimulate the *trophic* nerves, and this means the engenderment of activity in the nutritive processes, so that in the combined current we have effects distinct but essential to growth, repair and regeneration. Now let me draw your attention to

ELECTROLYSIS.—Wherever electric tension is sufficiently high, or more correctly speaking, when a current has sufficient electromotive force, its first effort is to overcome resistance by tearing the particles, molecules, or atoms asunder with which it comes into contact; this is known by the term *electrolysis*, and the substance which by this agency undergoes decomposition is called an *electrolyte*. I endeavoured at the beginning of the lecture to show you this by the decomposition of water, iodide of potass and the white of egg. Remember that large cells, as evidenced by the galvanometer in circuit, give a much more powerful current through needles inserted into the tissues than small ones. I will now bring before you examples of the value of electrolysis as a mode of therapeutics. When the galvanic current for the electrolytic dissolution of tumours was first made known, it was too hastily and rashly concluded that the barbarous system of surgery would be replaced by the elegant and refined system of electrolysis, but it was soon found by all practical and sensible, and, I might add, honest men, that operations by electrolysis (I will take, for example, cancerous growths) were, instead of being elegant and refined, cruel, barbarous, protracted and disgusting; still, for some very minor operations, such as the destruction of nævi and small *non*-cystic growths, it was deserving of passing attention; but the credit of the revival of electrolysis in medicine is due to M. Apostoli, of Paris, and when the results of his labours became known an extensive field was at once opened for the desultory use of electricity by men of enterprise who previously knew nothing whatever of a galvanic battery or electrolytic operations. Wonderful results were recorded, in some cases *tumours* disappeared as if by magic, when the results were in all probability more due to the potter's clay than to any electric agency.

Apostoli's use of electricity (for instruments see *Figs*. 57-60). From what I have told you in this and the preceding lecture, I feel sure that with a little explanation you will readily see and comprehend the nature of M. Apostoli's operation for the treatment of fibroid tumours of the uterus. The apparatus to be complete must consist of—

1st, A battery of sufficient electro-motive force.

2nd, A galvanometer for measuring strength of current.

3rd, An electrode (kathode) for uterine or inter-uterine application of the current.

4th, An electrode (anode) consisting of a mass of potter's clay.

The strength of current used varies from 50 to 150 and 250 milliampères.

"These large doses," says M. Apostoli, "are rendered tolerable in consequence of a new form of electrode, the wetted clay, which renders the cutaneous pole innocuous, and permits us to transmit through it easily and without injury a current of signal medical intensity."

The active pole, or kathode, is applied directly to the uterus, either in its cavity or in the substance of the fibroid deposit.

The positive pole (anode), or potter's clay, is applied upon the abdomen.

The effect resulting from the circulation of the current M. Apostoli designates "interpolar action," which sets up a subsequent process of "chemical disintegration" (proportionably wide and lasting) of the morbid products through which it is made to pass; he says, "In availing myself to the utmost of the 'polar' and 'interpolar' effects of the electric current for the treatment of fibromata, I adopt always a galvano-caustic (kathodic) *intra*-uterine and *monopolar* action. I thus only use directly one active pole, closing the circuit outside the abdomen by a second pole, made nearly as inert as possible. At the same time I reckon upon the interpolar effects of the current, as it necessarily finds its way through the entire uterine substance from the internal pole to the external cutaneous pole."

M. Apostoli speaks of the difference of the action of the two poles as follows, they are worth remembering: "I have been able to demonstrate in the clearest manner that we have in our hands a double-edged agent that we can make use of at discretion, to afford us local effects quite different. On the one side is a hæmostatic more or less rapid in its action, and either direct and immediate or secondary and remote. I allude to the positive pole, with which we can arrest hæmorrhage, either instantly, if the cavity of the uterus be of normal dimensions, if the action be relatively intense, and if the hæmorrhage be not excessive; or more deliberately and gradually, after several successive operations, by the formation of contractile cicatrices. The various gradations of the narrowing of the uterine canal are the plain evidence of this secondary and prolonged effect of positive cauterisations. The positive pole will therefore be the remedy *par excellence* in cases of bleeding of hæmorrhagic fibromata. On the other hand, with the negative pole we obtain a state of temporary congestion, without direct hæmostatic effect. The interstitial circulation of the uterus, thus momentarily stimulated, will be hurried on, and a regression of the non-hæmorrhagic fibromata is the consequence, either of this state of congestion, or of the supplementary artificial and salutary hæmorrhages which take place. The negative pole will therefore be found to render invaluable benefit (though with the positive pole it is possible to arrive at the same point by a way more indirect and tedious,) in those cases of fibroids accompanied by amenorrhœa and dysmenorrhœa, which are only too often the despair both of patients and medical men without such means at command."

Concerning galvano-puncture M. Apostoli says, "The indications for galvano-puncture are twofold; first as a matter of necessity in consequence of uterine atresia, or where there is such displacement of the organ as to prevent any introduction of a sound; second, by preference when we see that we can advantageously combine punctures with intra-uterine cauterisation, so as to expedite and make sure of the effects that, with the cauterisations only, we should tardily or perhaps imperfectly realise. We must, therefore, undertake the galvano-punctures alone whenever the case will fairly admit of them, or use them in other cases as adjuncts to the intra-uterine cauterisations previously tried.

"The manipulations in the operation of galvano-puncture will always be more difficult and even dangerous in incautious hands. I cannot, therefore, too much insist upon a rigid observance of the directions and precautions I have elsewhere given at length. I can now only offer a very short summary of them:

"(1,) Absolute and regular antiseptic irrigation of the vagina, before and after each operation.

"(2,) Use as the puncturing instrument a small steel trocar or needle, and let the punctures be shallow, that is, not deeper than from one to two centimetres.

"(3,) Make the punctures on the most prominent part of the fibroid; whenever possible in the posterior *cul-de-sac*.

"(4,) Make the punctures without speculum. Slide the trocar through the celluloid sheath which protects the vagina, after having examined and chosen by touch the point where the puncture is to be made.

"(5,) Take the precaution of ascertaining the seat of any pulsation, so as to avoid wounding an important vessel.

"(6,) In case of any unusual hæmorrhage, immediately dilate the vagina with an expanding speculum, and, if necessary, put on pressure forceps to the bleeding point."

Clinically.—The results are less striking; they are not only matter of proof by the examination of the surgeon, but the patient herself is the living exhibition of them. We may generalise the extent and importance of these results by saying that ninety-five times out of a hundred they comprise the suppression of all the miseries constituting the fibroidal symptomatology, which may be thus categorically enumerated: hæmorrhages, the troubles of menstruation, dysmenorrhœa, amenorrhœa, nervous disturbances, the direct pains in the growth itself and from mechanical pressure, and the harassing series of reflex actions.

Dr. Apostoli's internal electrode consists of a rod of platinum twelve inches long, of the thickness of an ordinary uterine sound, rounded as a probe at one end and pointed at the other. This platinum rod can be fastened into a handle by a screw-swivel on its side, so that either end of the rod can be passed into the handle and secured there when the other end is wanted for use. A certain length only of the platinum is required to be bare so as to act within the uterus, the other part of the long rod is covered by a celluloid or vulcanite tube, which acts as a sheath and protects the vagina and other soft parts from the action of the current.

Dr. Stevenson makes the following practical suggestion with regard to the positive pole: "When the positive pole is used, the electrode must be made of platinum, as all other metals are more easily oxidised, and are decomposed by the action of the current. This would often cause them to adhere to the electrolysed tissue, and their forcible removal might cause hæmorrhage. The positive pole is generally used in soft, bleeding fibromata on account of its hæmostatic action; therefore, if the electrode were not composed of platinum, the object wished for might not be obtained, but, on the contrary, a risk might be incurred of making matters worse. The negative pole is used for dense, hard fibroids when the patient suffers from dysmenorrhœa, amenorrhœa, and pressure and 'bearing down' troubles resulting from the size and weight of the tumour."

Dr. Apostoli gives the following rules for the electric treatment of peri-uterine inflammation (perimetritis, parametritis, phlegmon cellulitis). He varies the treatment according to the acute, sub-acute, and chronic stages of the disease:

(1,) *Acute stage—bipolar faradization.*—The application is *simply vaginal* by means of a large bipolar electrode, the point of which is placed against the inflamed part; the strength of current must be bearable and the sitting should last five, ten, fifteen, twenty, or twenty-five minutes, and should not terminate before the patient spontaneously declares that she suffers less pain. The action of the current is *sedative.* Every faradization should be preceded and followed by a vaginal irrigation of sublimate solution.

(2.) *Sub-acute stage.*—When the inflammation has subsided the galvanic current is called into action and carried *within the uterine cavity,* the *positive* electrode only being used to the uterus itself; the sittings at the commencement extending only to *three* or *four* minutes, and the intensity of the current must not be more than from twenty to forty milliampères. One or two sittings a week may be made, regulating the intervals by the strength and condition of the patient. Rest in bed after each operation must be enforced.

(3,) *Chronic stage.*—In this stage the operation is that of *intra-uterine chemical* galvano-puncture, *negative* pole, *monopolar;* the *negative pole* is pushed into the most prominent part of the exudated mass, if possible, *on the parts* posterior to the uterus; the speculum is not used. The central or projecting part of the deposit is ascertained by the finger, and the trocar is guided by the finger and passed into the swelling to a depth of not more than one centimetre. The punctures must be as short as possible, long punctures are both *dangerous* and *useless,* and may injure the peritoneum or pierce a vessel and give rise to troublesome hæmorrhage. The strength of current may be raised from fifty to two hundred and fifty milliampères, and the current should be kept running for five minutes—antiseptics and great cleanliness are necessary from first to last.

Dr. Apostoli speaks of the essentials of his treatment in the following words: "To sum up in a few words the essential parts of my researches, and the clinical results which have been worked out from them, I may say:

"(1,) Electricity, in the form of faradic currents of tension, can, and ought to be made to calm the pain at the outset of an acute attack of perimetritis, and is a sedative of the first importance in abridging the first stage of inflammation.

"(2,) The continued current is a power which we use in two ways: first, in the form of intra-uterine chemical galvano-cauterisation, to cut short the acute stage; second, as vaginal, negative, galvano-punctures, to get rid of the chronic condition in all its forms and stages.

"Is the restoration *ad integrum*, complete and definitive, the prevailing result of my treatment? I do not pretend that such is the case; I do not even expect it; and I content myself with offering for trial a method of relief and cure which I believe to be more speedy than any others.

"Again, we may force electricity into our service in another way. Given a case of actual suppuration, or of threatening suppuration, we have only to use our negative galvano-puncture, form an eschar, open up a sinus, and direct the exit of the pus to the nearest point of the vagina. And this we can do at will, when it is most fit to do it, and in the most convenient way.

"We have, then, in the galvano-puncture, an effective means of arresting an inflammation, and of dispersing an inflammatory deposit. Or, we may use it as a sure and direct way of opening a profound and ready formed collection of pus. No plan of setting up a vaginal drainage, controllable as to amount and duration, can be more simple; and this we may associate with any local and antiseptic treatment that may be desirable, as I have shown elsewhere in relation with the subject of hæmatocele.

"The subject, of which I have just jotted down the salient points for your consideration, is new and undeniably full of interest. You must not suppose that I think I have done much for it, as I may fairly claim to have done for fibromata and endometritis, but what I have seen and watched with painstaking anxiety, is so rich in clinical results, so fertile in unexpected therapeutical consequences, that I feel I cannot too earnestly urge you to study the subject for yourselves, and to fathom it to the utmost, if possible."

Sir Spencer Wells, in a masterly review of the electrical treatment of diseases of the uterus, read before the Brighton and Sussex Medico-Chirurgical Society, sums up as follows: "Experience seems to show that there is a group of cases, numerous as they are troublesome, of chronic metritis with enlargement and surrounding deposits, which may be cited as pre-eminently eligible for electric treatment. They are, as regards the patient, painful and exhausting. To the judicious surgeon they are exasperating by their rebelliousness, and in some rash hands they have opened the way to practice more lamentable than the disease. It will be one of the crowning merits of electro-therapeutics if proved to be equal to bring relief to these patients. Recent reports give good reason to hope that this end may be realised by a careful use of the positive galvanopuncture."

ELECTROLYSIS OF NÆVI.—The electrolytic treatment of nævi commends itself specially to our notice. It is a simple process, easy of application, invariably successful, *and never leaves a scar*, and in many cases it is almost painless. Of this there can be *no doubt*. The current should be from 20 to 60 milliampère strength, and the duration of the current flow must be judged according to the size of the tumour to be operated upon. Some operators use both poles, and if the swelling be large it may be better to do so, but care must be taken that the needles do not come into contact within the nævus, as this would short circuit the current and stop all action. The needle attached to the negative pole is the prime actor. As we have seen, it produces complete disintegration of all the structures with which it comes into contact. When once introduced it should be moved about freely in every direction. If the tumour is large it may be removed and introduced into some other part of its substance. The needles are such as we find represented in Fig. 56, and are insulated in the great part of their course. A solution of cocaine previously injected will insure the operation being quite free from pain.

ELECTROLYSIS IN GOITRE.—The galvanic current is very often serviceable in goitre, and the treatment to be adopted must be precisely similar to that of which I have just spoken to you for nævi.

ELECTROLYSIS IN ANEURISMS.—Dr. de Watteville emphasises that the utmost confusion and uncertainty reigns in the literature of the electrolytic treatment of various tumours and the like. He says, "The hopelessness of arriving at any conclusion from the recorded observations of electrolysis in *aneurism* is manifest the moment we look through the tabulated lists of cases given by Poore, Bartholow and others." The following rules are laid down by him as the result of his experience, and are worthy of respect.

1. To introduce into the sac several needles connected with the *positive* pole of the battery, which obviously must have the requisite electro-motive force and depolarizing energy (the bichromate of potash or Grenat element). The usual small medical Leclanché elements are scarcely suited to the purpose. The current must be closed with one or more very large plate electrodes, which may be applied to any part of the body.

2. To use needles with thoroughly insulated shaft with spear-headed points, taking care that the whole exposed part of the metal be within the sac.

3. To use a measured current strength of 20 or 30 milliampères at most *per needle*.

4. To allow the current to flow for about half an hour at the first sitting, and increase the duration subsequently according to the results obtained.

The needles should be removed very gently with a rotatory movement, and the external wound immediately closed with lint soaked in collodion, and a bag of ice applied over the aneurism.

Dr. John Duncan, of Edinburgh, has written a very interesting paper which will be found in the "British Medical Journal" for November 3rd, 1888, on the value of electrolysis in angeioma, goitre, and cirsoid aneurisms.

ELECTROLYSIS OF STRICTURES of the urethra and lachrymal duct.—There seems a probability that this mode of treatment may become more fully recognized than at present. Dr. Steavenson has given to this subject considerable attention, and has written favourably of its effects. It appears to have originated in America, and good reasons are brought forward for its general application. From the purely electrolytic point of view it should be acknowledged as a mode of treatment for these troublesome affections. The negative pole should be used with a strength of current just sufficient to decompose water.

OVARIAN PAIN, *vaginismus, and hyperæsthesia of the external genital orifice in women.*—I have again to refer to the work done by M. Apostoli in this line of treatment, because his experience is so large and his statements so thoroughly reliable that they need no commendation from me. I can from my own practice bear out the usefulness of his advice in the electric treatment of ovarian pain, but this is not the case in the other conditions to which I am about to refer. I cannot attach too much importance to this subject, for I am quite sure if we relieve a woman of these distressing symptoms as M. Apostoli's treatment seems to do, we at once transform a miserable, wretched existence into that of happiness and comfort. For ovarian pain the induced current of *tension* is used in one of two ways, *intra-uterine bipolar* and *vaginal bipolar;* the intra-uterine will always be *preferable,* as more *active* and *efficacious,* whereas the vaginal operation is forced upon us by such circumstances as the impossibility of passing a sound into the uterus. This will be our dilemma in pregnancy, in virginity, or in an acute stage of peri-uterine inflammation.

The length of the sitting should continue until the pain has diminished or disappeared. The sittings should be continued daily. No pain ought to be inflicted on the patient, first, because it is useless, and secondly, because too strong an application might do harm.

It is a peculiarity of the greater number of hysterical women that they bear easily the faradic currents of tension, even with the fullest dose, so well, in fact, that after a short time they will affirm that they feel nothing. A novice might thus imagine that his apparatus had failed or that there was an interruption of the current.

The following is what Dr. Apostoli calls his last and third contribution to gynæcological therapeutics, and to my mind it is of great significance: "There are many women who, independently of ovarian neuralgia, have intense and very localized sensibility about the entrance and lower part of the vagina. These are cases of imperfect vaginismus in which the torment is so unbearable and the hindrance to connection so complete that life is rendered miserable. The difficulty of overcoming this trouble is only too well known. I have had to do with a large number of interesting and instructive instances of this affection. For example, in one woman I found a single neuralgic spot not larger than the tip of the index finger just at the end of the right nympha. Another had the same condition exactly at the posterior commissure. In a third the excessive sensibility was confined to the orifice of the urethra. The fourth case had a similar neuralgic area on the left side of the vestibule. Beside these single spot cases I have seen many others in which the localization was not single, and the extent varied. The remedy of which I have availed myself and now recommend for ridding women of these harassing annoyances is the faradic current of tension well and methodically applied. Faradism only relieves when we observe certain fixed and precise rules in its application." A fuller account of these modes of treatment can be found in the "British Medical Journal" for January 14th, 1888.

Muscles and Joints.—It is quite possible that galvano-faradisation is more useful in the ordinary affections of muscles and joints than in any other class of disease. It relieves pain, promotes nutrition, and restores function, and especially when it is used in association with massage. Massage, however, comes first in point of value, but second in period of time: everyone in a climate like ours must be familiar with cases of chronic rheumatism. The pain may be located in a few muscles, or it may be extended over a considerable area, there may or may not be absolute tenderness, the pain may be greatly increased upon movement, and both joints and nerves may be involved. In all such cases the parts must be thoroughly faradized and submitted to the current, applied by means of large sponge electrodes. The sponges may be saturated with hot vinegar and water, which I find in these cases increases its efficacy. The relief to pain is sometimes remarkable. The operation should last for about ten minutes; the current should be gradually increased until it just becomes painful, and it should be repeated every day, not only until the pain has been entirely relieved, but for a few times after, as this seems to prevent a relapse. At the end of each application, to ensure absolute contraction of muscle, it is my practice to place one of the electrodes over the motor point of each muscle, and stimulate it and the nerve by a succession of some dozen current interruptions; after this a series of massage manipulations hasten the cure. In *joint* pain from *sprain*, *rheumatism* or *gout*, my mode of procedure is very simple, but efficacious; the joint is swathed in flannels which have been wrung out of hot vinegar and water, and over this is placed a piece of very thin perforated zinc which forms the positive electrode. The negative electrode, which should be large and not too wet, is applied to the most convenient part of the body; the current is allowed to flow for ten minutes, and is wound up with a few voltaic alternatives; after this the joint must be well *extended* and flexed some twenty times, and then masséed. This mode of procedure will be found very advantageous for the knee, shoulder, and elbow joints, but for the wrist and ankle joints the foot and arm bath are very convenient and useful. A joint which is too tender to bear movement or pressure before these applications of electricity will be comparatively painless after, and the opportunity should be taken to manipulate them freely. You must clearly understand that I do not advise the application of electricity or massage to a joint in a state of acute inflammation, but I can honestly recommend galvano-faradization as particularly useful in all chronic joint affections, and in simple *muscular atrophy* from disuse, take the muscles of the forearm, for instance, after Colle's fracture. By massage and galvano-faradization the arm is restored to use in one third of the time that it would be if left to the ordinary modes of manipulation, and without the patient experiencing a tithe part of the pain.

Abdominal Faradization.—In many obscure abdominal neuroses galvano-faradization is unquestionably useful. Every one must be acquainted with vague abdominal sensations and pains which cannot be traced to any definite assignable cause. They are classed under the head of neuralgias for this reason, and, as well as being very distressing, they are not curable by ordinary remedies. The pains are frequently periodic, and have a stage of intensity, they are sometimes referred to the stomach, and known as *gastralgia* or *dyspepsia*. They are often cured by galvano-faradization, even when they are of long standing. My mode of operating is to place a large sponge electrode (positive pole) over the region of the cæliac plexus (a large sponge attached to a zinc plate) and the negative *sponge* electrode must be placed upon the spine in the mid dorsal region. The current should be allowed to flow for ten or fifteen minutes, occasionally interrupted by voltaic alternatives. I have had some very satisfactory results from this plan of treatment, and I can therefore speak of its value from my own experience. *Vomiting*, of functional or nervous origin, which we know sometimes to be very intractable, will yield at once to galvano-faradization in the manner just described. *Chronic constipation* may be similarly treated with like good results. I have no time to enter fully into these conditions, and there is no necessity to do so. They require nothing for their treatment but the most ordinary and generally recognized simple methods of procedure.

Locomotor Ataxy.—If we cannot cure this troublesome disease, we can relieve many of its vicious and distressing symptoms by galvano-faradization, by static electricity, and by suspension. Of the last mode of treatment I have at present nothing to say, but in the treatment of the troubles associated with locomotor ataxy, if we are unable to cure the disease and mitigate the symptoms by drugs, surely no means under heaven should be left untried to relieve a class of affections which are as deplorable and disastrous as any with which poor human creatures are afflicted; there is no special sense or function from the crown of the head to the soles of the feet which may not have to run the gauntlet of its vile and baneful influence. I cannot speak too strongly upon this matter, neither can I even enumerate the perverse functions due to sensori-motor derangements arising from degenerative changes in the postero-root zones of the spinal cord. I will mention one or two of the common troubles merely for distinction, such as the following: lightning and other pains commonly known as rheumatic derangements of vision, spasm of involuntary muscles in all or any of its regions, nervous pains, respiratory and cardiac defects, gastric pains and vomiting, abdominal neuroses, rectal and bladder troubles, inco-ordination of movement and dysæsthesia. Now what are the usual remedies adopted to meet these nerve derangements? As a rule the pains are palliated by the use of cocaine, opium, chloral, and the like, the obstinate vomiting by gastric sedatives and counter-irritation to the epigastrium, the bladder troubles by henbane, potash, pareira-brava, couch grass, and so on; in fact, the local symptoms are frequently treated as cause and effect, when they are too often the effect of a remote cause.

I have met with considerable success in the treatment of the symptoms just referred to by the galvano-faradic current, more so with hospital than with private patients, for the reason that they have followed up this means of relief with greater assiduity. It is now rather the exception than the rule for patients *not* to be relieved of one, certainly, of the most distressing symptoms, "the lightning pains," by galvano-faradization; the positive electrode (a flat zinc plate well covered) is applied to the nape of the neck, and the negative electrode is a water metal foot bath half filled with salt and water, the current has a minimum of faradism compared with galvanism, and the strength of currents must be gradually increased (*without alternatives*). In the first six sittings I prescribe a current of only six milliampère strength daily, for six days, ten minutes being the time of duration of each sitting, but this is gradually increased until the sitting extends to half an hour and the current strength equivalent to twenty or even thirty milliampère. In some cases the bladder and rectum have been quite restored to normal functional activity, and co-ordination has improved to such an extent that patients have been able to dispense with their walking sticks as aids to progression. Of course I may be told that these are cases of peripheral rather than central nerve change, but, nevertheless, there has been an absence of knee reflex as well as the usual ocular symptoms significant of central disease, with which I venture to think I am fairly well acquainted. I have never yet satisfied myself that locomotor ataxy is the incurable disease that it has generally been considered, and the time must come when we shall find means to combat with greater certainty some of its more inveterate symptoms, and render the lives of the unfortunate people more tolerable than we at present find them. I am quite sure that the mode of treatment to which I have just called attention acts directly upon the nutritive processes of the spinal cord, allays its irritability, and helps to promote its initial normal reflex activity. If we gain and maintain so much there is no knowing what we might effect in arresting the onward progress of the disease, and possibly bring about compensatory measures of which we are at present very ill-informed. It has been proved that electrical excitation of a peripheral nerve does give rise to change in the medulla oblongata, and furthermore we have evidence in proof that the motor nerves, or their terminal endings, exercise an influence on the nutrition of the cord. Therefore it is quite possible that the influence of the current upon the peripheral endings, innervated by a diseased centre, sets up certain changes in that centre, which restore to them, in a measure, a fair amount of normal power.

NEURALGIA.—I cannot say that I have ever been very successful in the permanent cure of neuralgias by electricity alone. I have certainly tried the currents, both faradic and galvanic, in all forms of neuralgia over and over again, unipolar, bipolar, and so on, but it has only in exceptional cases given permanent relief; in those where I have used the faradic current, say in cervico-brachial neuralgia and sciatica, the pain has been relieved completely for the time, but it has invariably returned. From my own experience, I have come rightly or wrongly to the conclusion that the positive galvanic current applied directly to the nerve is the most efficient mode and the one most likely to lead to permanent results; but massage, aided by the galvanic current, has been much more effective than either massage or electricity alone. In old standing cases of neuralgia, "sciatica particularly," where the power and function of the nerve have become much weakened, strong faradization is quite inadmissible.

Brain and Spinal Cord, Electrization of.—In functional diseases of the brain and spinal cord the combined faradic and galvanic currents are of value as aids to treatment; I prefer the combined current in every case. Sometimes the galvanic current should be in excess, at other times the faradic current, and I cannot lay down any definite rule as to the quantity of either or of both, so much depends upon the sensibility and sensitiveness of the patient. I have failed to obtain either in chorea or epilepsy any good effects which I could positively ascribe to these agents. I have sometimes thought that charging the body with the static positive current has been useful in chorea, but I have had no striking results, and after a very large number of trials, both in hospital and private practice, I am compelled to leave the question undecided. Now and again one gets remarkable and apparently direct beneficial influences, but these are negatived by a succession of cases where the effects are nil, and when such cases exist it would be unwise to laud a mode of treatment where success is doubtful and equivocal. I do not wish to give an adverse statement, but from a large experience this is simply the opinion which I have formed. As regards epilepsy I do not think that electricity is of any good whatever.

Incontinence of urine in children may sometimes be cured by the application of a weak combined current to the spine for three or four minutes every night at bedtime. I think this affection may be classed among the neuroses. Some authorities believe that it is frequently due to excentric irritation; this may be so, but in my opinion it is caused by inhibition of the normal control centre for the bladder sphincter in profound sleep. This incontinence, which, to say the least of it, is a very annoying affection, is not confined alone to children, it sometimes occurs in persons over twenty years of age. A gentleman, an epileptic, twenty-three years of age, consulted me a few months ago for this condition which gave him very great trouble; large doses of bromide of potassium and belladonna did him no good, but a brisk galvano-faradization of the spine for ten minutes before going to bed quite cured him. I have tried the same treatment in children with very good results, so I can commend it.

WRITER'S CRAMP.—I have spoken of this troublesome affection, and laid down rules for its treatment in Lecture V. A great deal of harm might be done in these cases by injudicious faradization.

NEURASTHENIA AND HYSTERIA.—Electricity in these affections is of uncertain value when applied alone, but as part of a system of treatment it certainly has advantages which cannot be ignored. Electricity is a valuable aid to massage manipulations, but I quite agree with Weir Mitchell, given the two remedies for choice, massage is far more effectual, reliable, and efficient than electricity, as a remedial agent.

SPINAL CORD.—I am inclined to the belief that galvanization or faradization applied directly to the spinal cord in chronic myelitis is not attended with very beneficial results. There are, however, functional states of the spine, not referable absolutely to the cord alone, where the combined current seems to do good.

The choice of the pole may be said to depend upon the state of the spine: if there be irritability and great tenderness over certain areas the anode or positive pole should be applied; on the other hand, if there be an atonic condition the negative pole or kathode should be applied; the current must be gradually increased in strength from five, ten to twenty milliampères; it may be labile or stabile, but what I generally prefer and find much more efficacious is faradic manipulation, it has in my practice quite superseded the other methods, and the results obtained are much more uniform and satisfactory; but I have referred to this at length in my former lectures: in spastic paralysis any local application of electricity to the spine is quite useless, and so it is in paraplegia from pressure in angular curvature.

THE BRAIN.—The galvanic current should exercise an important influence upon the circulation as well as upon the nutrition of the brain. I am quite sure that I have sometimes obtained good results from this mode of treatment in hysteria, hysterial headaches, and migraine; I know nothing of the effects of electricity *in organic disease of the brain.* Dr. de Watteville, who seems to agree with Erb in this matter, writes as follows: "For the purpose of electrizing the brain the galvanic current should be used, the electrodes should be large and made to fit closely the surfaces to which they are applied, the flexible plates covered with chamois leather answer this purpose very well, and should be placed so as to secure the utmost density in the region of the *lesion*. The current should be weak or very weak (4-12 cells according to the state of the battery and the resistance of the patient's tissues), duration to be limited to one to three minutes at a time, cautiously increased if the subject bears it well. No sudden alterations should be made (stabile current). The following directions for galvanic applications to the head will be found useful.

"1. Longitudinal galvanization; one large flexible plate on the forehead, another on the occipital region.

"2. Transverse galvanization; one large or medium plate on the mastoid region on each side.

"3. Subaural galvanization; a medium sized electrode under the ear, the other on the opposite side of the head, forehead or nape of the neck.

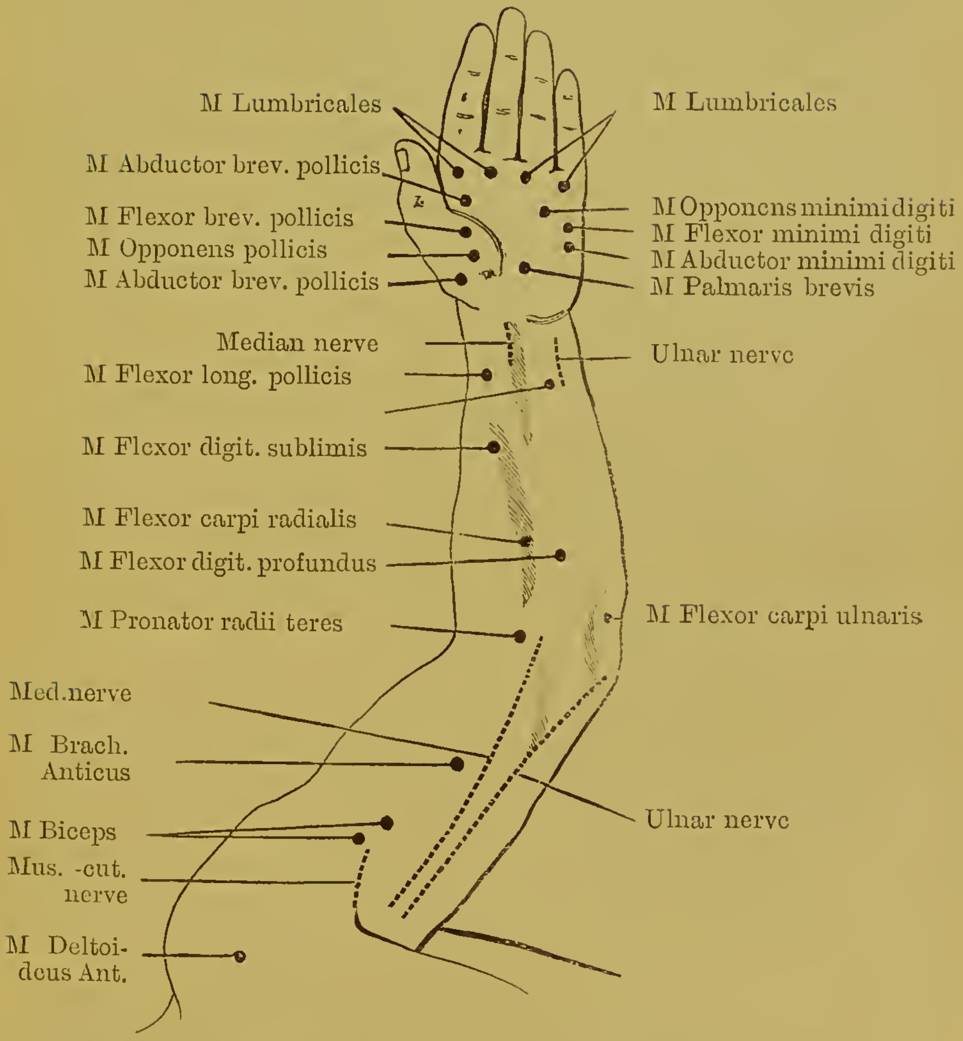
"4. Localized galvanization; one medium electrode over the actual convolution, &c., supposed to be the seat of the lesion, the other on the opposite side of the neck (oblique galvanization, Erb) or in the subaural position."

My own method of galvanizing the brain (labile) is somewhat different to the foregoing, and as far as I can judge it has all its advantages; it is a mode of procedure which I have occasion to adopt nearly every day of my life. I apply the flexible pad (anode) to the nape of the neck high up, and the other electrode (kathode), a large sponge, I move about from point to point, never releasing it from contact with the tissues unless the strength of the current has been previously tested; the current is thus carried to different parts of the brain. The special points of application for the kathode are the frontal region, the mastoid region, the subaural region and the submental region. It is only for functional diseases that I galvanize the brain, the more special of which are cerebral hyperæmia, cerebral anæmia, insomnia, hysteria, functional aphasia, hemicrania, hemi-cerebral anæsthesia, and cerebral neurasthenia. I make it a rule to use the galvanic current only, but sometimes I throw in a moiety of the faradic, and I think with advantage.

Facial Paralysis.—This very common affection of the seventh nerve should in the majority of cases be treated by galvano-faradization as early as possible; of course I am alluding to what is called peripheral paralysis generally due to exposure to cold, the objective features of which are so well known and so characteristic; the electric treatment should be labile; I prefer, and always use as the labile electrode a fairly sized sponge (kathode), placing the carbon electrode (anode) upon the point of exit of the nerves; it is well if the case is not of very recent date to test the degenerative reactions of the nerve before giving an opinion as to prognosis, but the great point in the treatment is to begin electrization as soon as possible after the receipt of injury.

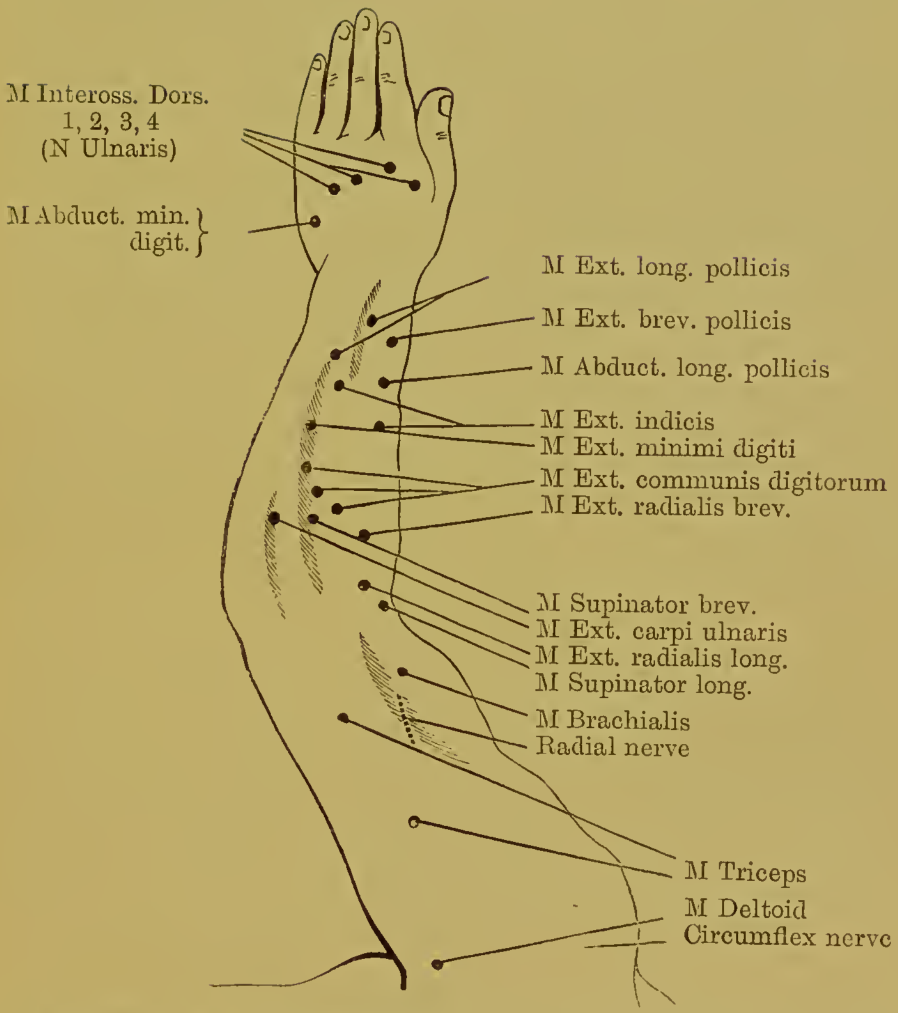
LEAD PARALYSIS.—*Paralysis of the extensors of the hand and fingers from lead poisoning.* — I thoroughly endorse Dr. de Watteville's view as to the causation of this condition, namely, that it is of spinal origin, "and consists in a functional disturbance of the grey matter, a poisoning of the cells, giving rise to an arrest of their functions, motor and trophic." In reference to prognosis, test for the reaction of degeneration; for treatment, use a labile current (kathode), placing the anode at the back of the neck low down.

ELECTRIC BATH.—The common form of electric bath consists in immersing the patient in an ordinary water bath of the temperature of 100° F; one pole of the battery is usually made of a large sponge connected to a metal electrode, and upon this the patient may sit, or it may be moved or fixed to any part of the spine as may be desired; the other pole is made of a large piece of metal which is fixed to the foot of the bath, or it may be made of a flat piece of metal which is attached to a long insulating handle so that the current can be concentrated upon and carried to any part of the body; either current may be used, but the faradic is usually preferred. At one time I used to order the administration of electricity in this manner, but I have long since abandoned it as untrustworthy, and of very doubtful therapeutical value.

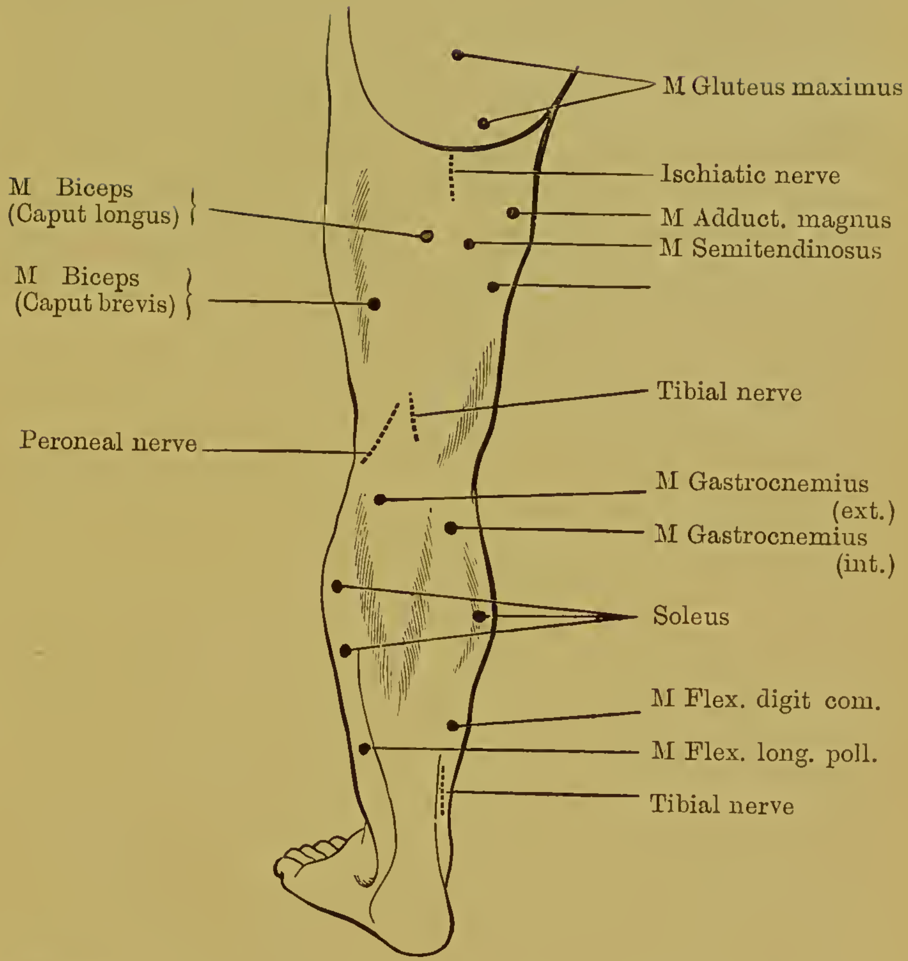


Motor points of muscles supplied by the median and ulnar nerves. Upper extremity—Anterior view.

PLATE I.

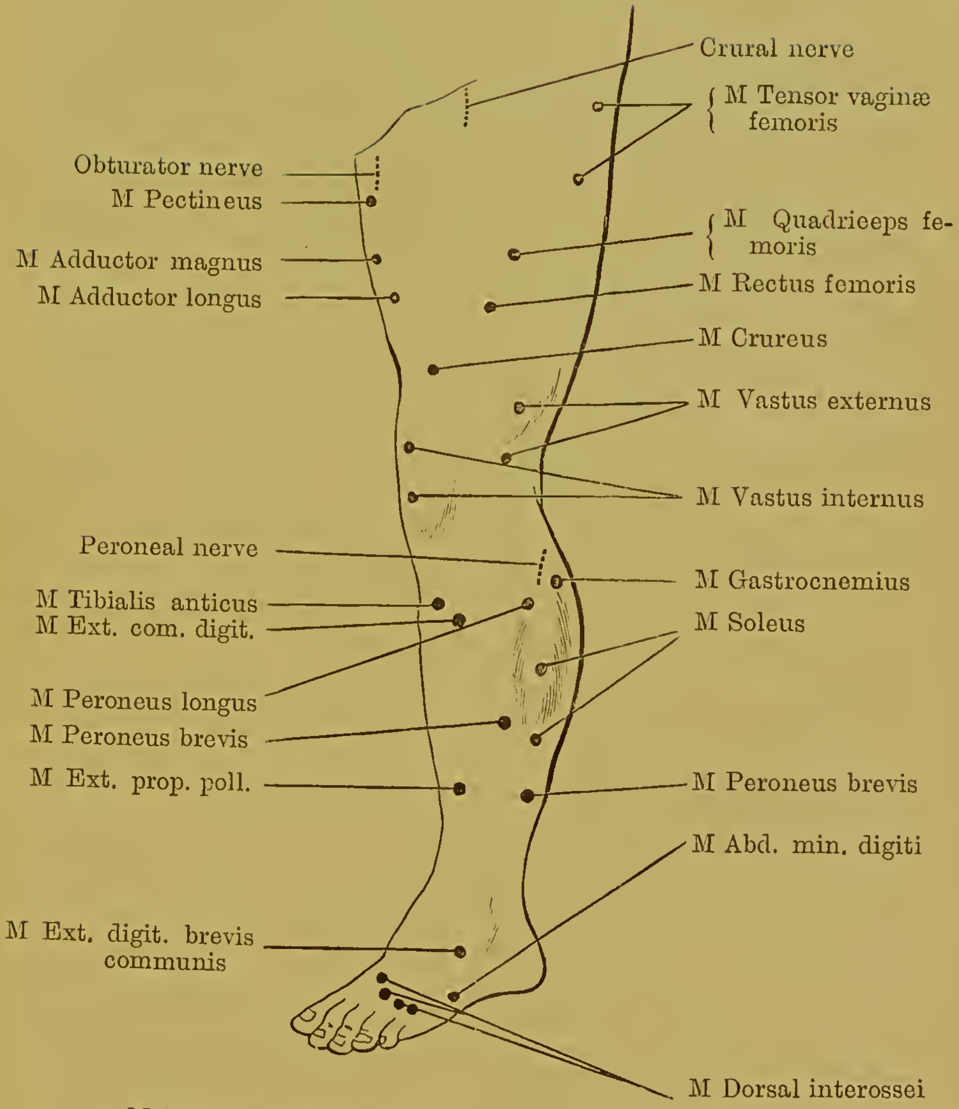


Motor points of muscles supplied by the radial nerve. Upper extremity—Posterior view.



Motor points of muscles supplied by Sciatic Nerve and its branches. Posterior views of lower extremity.

PLATE III.



Motor points of muscles supplied by peroneal nerve.

Motor points of muscles supplied by anterior nerve.

Anterior view of lower extremity.

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